AN INVESTIGATION OF NON-FINANCIAL FACTORS FOR THE APPRAISAL OF ENERGY INFRASTRUCTURE PROJECTS IN SUB-SAHARAN AFRICA

by

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ABSTRACT

During the project appraisal stage, a decision is made on whether to implement a project. Traditional project appraisal techniques largely focus on financial factors because investors require adequate financial returns for their investments. However, non-financial factors, led by policy and institutional frameworks, are also critical to the viability of a project. Employing a multiple case study design, this qualitative research investigated non-financial factors considered in the appraisal of energy infrastructure projects in sub-Saharan Africa. The three case studies that were investigated are the Menengai Geothermal Power Plant Project in Kenya, the Guinea-Mali Power Interconnection Project, and the Morupule B Power Plant Project in Botswana. Project appraisal is a decision-making activity, and therefore, multi-criteria decision analysis, real options, and other theories were explored in the literature review and linked to this investigation. This investigation used secondary data in the form of comprehensive project appraisal documents collected from the official online databases of the African Development Bank and the World Bank. Qualitative Data Analysis (QDA) Minor Lite and Microsoft Office software tools were used for data storage, analysis, and presentation. The researcher found that non-financial factors were applied in the appraisal of energy infrastructure projects in sub-Saharan Africa. These factors fell under political, environmental, technical, legal, social, organisational and managerial, and strategic and synergy categories. The researcher developed a framework for the application of non-financial factors in project appraisal, applying what was found in this investigation. The outcome of this investigation may assist project practitioners to effectively appraise projects.

Keywords: Energy infrastructure, non-financial factors, project appraisal, sub-Saharan Africa

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ACRONYMS AND ABBREVIATIONS

AFDB:	African Development Bank
AHP:	Analytic Hierarchy Process
AIDS:	Acquired Immunodeficiency Syndrome
BSC:	Balanced Score Card
CEO:	Chief Executive Officer
CO_2:	Carbon dioxide
CSV:	Creating Shared Value
DCF:	Discounted Cash Flow
DFI:	Development Finance Institution
GHG:	Greenhouse gases
EFCA:	Environmental Full Cost Accounting
HIV:	Human Immunodeficiency Virus
MCDA:	Multi-criteria Decision Analysis
MOOSRA:	Multi-objective Optimisation on the Basis of Simple Ratio Analysis
PPP:	Public-Private Partnership
QDA:	Qualitative Data Analysis
RO:	Real Options
SDG:	Strategic Development Goals
SRON:	Social Return on Investment
TSI:	Total Societal Impact
UN:	United Nations

CHAPTER 1
INTRODUCTION

1.1 Introduction

This chapter gives the background to the investigation into non-financial factors for the appraisal of energy infrastructure projects. This is followed by the problem statement, research questions and objectives, and finally, the chapter outline for this dissertation.

1.2 Background to the investigation

1.2.1 Project appraisal

In the early phases of a project's life, a project is appraised to decide whether it will go ahead. Dimitriou, Ward, and Dean (2016:7) defined project appraisal as "a process of exploration, review and evaluation of a proposed course of action carried out by a party (or several parties) to determine whether a given proposal is viable". According to Moutinho and Mouta (2013:4), at the appraisal stage, project appraisers have the following options: Request a re-work of preparatory activities, put the project on hold, abandon the project, or advance the project into the implementation phase with or without changes in scope. A good project appraisal selects a project that increases the probability of maximising socio-economic benefits (Taliercio and Estrada, 2020:249). Project appraisal is therefore a critical activity in the initial phase of a project cycle, and project practitioners need to take it seriously.

Traditionally, project appraisal focuses on financial and technical viability (Lopes and Flavell, 1998:223; Mohamed and McCowan, 2001:231). Common financial techniques for project appraisal use discounted cash flow (DCF) models with the key metrics of internal rate of return, net present value, and pay-back period (Mohamed and McCowan, 2001:231; Venetsanos, Angelopoulou and Tsoutsos, 2002:293; Moutinho and Mouta, 2013:1; Ofori et al., 2021:2). Financial techniques are popular in project appraisals because many investors focus on adequate financial returns from investments (Mohamed and McCowan, 2001:231; De Nooij, 2011:2; Moutinho and Lopes, 2011:7; Ojo, 2021:108); however, often little consideration is given to non-financial factors.

1.2.2 Non-financial factors of project appraisal

Haselip, Desgain and Mackenzie (2015:78) defined non-financial factors as matters "linked to the wider social, economic, and policy environment", including institutional and social aspects. For a project to meet its objectives, non-financial factors play a major role. However, historically, little consideration has been given to non-financial factors in project appraisal (Mohamed and McCowan, 2001:232; Moutinho and Lopes, 2011:7; Haselip, Desgain and Mackenzie, 2015:78; Batra and Verma, 2018:82).

Unlike with financial techniques, researchers are yet to reach an agreement on project appraisal methods that can successfully assess non-financial factors. Lopes and Flavell (1998:232) found that there is little guidance on applying non-financial factors in the project appraisal process, and there are limited empirical studies on the non-financial aspects of project appraisals (Lopes and Flavell, 1998:224; Moutinho and Lopes, 2011:3; Batra and Verma, 2018:82). Masini and Menichetti (2013:515) observed that most studies on investment decisions focused on finance theory, and that there is a general lack of understanding of the effect of non-financial factors on project appraisals. Haselip, Desgain and Mackenzie (2015:78) and Mota and Moreira (2015:1572) found that while non-financial aspects are critical to project execution, these factors have not been adequately discussed in literature.

1.3 Problem statement

Sub-Saharan Africa is the terrestrial area in Africa south of the Sahara Desert. According to the World Bank (2021a), there are 48 countries in sub-Saharan Africa. Sub-Saharan Africa has lagged behind other regions of the world in the implementation of infrastructure projects, including energy infrastructure, such as power plants and transmission lines (Eberhard and Shkaratan, 2012:9; Calderon, Cantu and Chuhan-Pole, 2018:3). Approximately 585 million people who live in sub-Saharan Africa (around 63% of the population) have not been electrified or do not use electricity in their homes (Adedoyin et al., 2021:2). Many energy infrastructure projects in sub-Saharan Africa with big potential for socio-economic impact have remained under planning or have not successfully passed the appraisal stage (African Development Bank [AFDB], 2021). In 2015, the United Nations (UN) adopted 17 sustainable development goals (SDGs), with SDG no. 7 specifically "aiming at ensuring access to affordable, reliable, sustainable, and modern

energy for all by 2030" (Schwerhoff and Sy, 2017:393; Blimpo and Cosgrove-Davies, 2019:11; Mansell and Philbin, 2020:43). Implementing sustainable energy infrastructure projects is one measure towards achieving the SDGs. However, considering the current electricity access rates, Tarekegne and Sidortsov (2021:2) observed that a considerable part of the population in sub-Saharan Africa will still have no access to electricity by 2030.

It is postulated that many energy infrastructure projects in sub-Saharan Africa have not passed the appraisal stage or have not been successfully implemented because of poor consideration of non-financial factors.

The problem is multi-faced: i) Researchers have not yet converged in their understanding of non-financial factors for project appraisal; ii) there are no known frameworks for applying non-financial factors in the appraisal of energy infrastructure projects in sub-Saharan Africa; and, iii) it is imperative that sub-Saharan Africa countries speed up preparing and commissioning energy infrastructure projects to meet the target set by the UN in SDGs.

This research on non-financial factors for the appraisal of energy infrastructure projects in sub-Saharan Africa is thus very necessary. It is envisioned that this research will contribute to the wider debate regarding deficient infrastructure development and electricity poverty in sub-Saharan Africa. Furthermore, the outcomes of this research may contribute to the current body of knowledge on project appraisal for use by various project practitioners.

1.4 Research aim

The aim of this research was to explore and investigate non-financial factors that should be considered in the appraisal of energy infrastructure projects in sub-Saharan Africa.

1.5 Research questions

The investigation attempted to answer the following main research question: What are the most prevalent non-financial factors that should be considered for the appraisal of energy infrastructure projects in sub-Saharan Africa?

The study also attempted to answer the following subsidiary questions:

i. To what extent are non-financial factors applied in the appraisal of energy infrastructure projects in sub-Saharan Africa?
ii. Who are the key players in the appraisal of energy infrastructure projects in sub-Saharan Africa?

1.6 Research objectives

The study had the following research objectives:

i. Conduct a comprehensive literature review of theories about decision-making in relation to project appraisal;
ii. Conduct a comprehensive literature review of previous studies on the appraisal of infrastructure projects;
iii. Explore and investigate non-financial factors in energy project appraisal in selected multiple cases in sub-Saharan Africa using qualitative research methods; and
iv. Based on the findings of the investigation, develop a framework to apply non-financial factors to the appraisal of energy infrastructure projects in sub-Saharan Africa.

1.7 Scope and delimitations

Scope and delimitations are the boundaries of the investigation or study, and these are defined by the researcher to meet the objectives of the research work with the limited available resources (Ross, Gotzek, Ascunce and Shoemaker, 2010:157). This investigation generally looked at energy infrastructure projects in sub-Saharan Africa. Only projects for electric power supply were considered. The specific scope of the study was the appraisal stage of the projects. The focus was the point at which a project had been prepared and the decision of whether to go ahead with the project was pending. A multiple case study research design was used but the number of case studies were limited to three. The aim and objectives outlined above were part of the scope and delimitations of this investigation.

1.8 Conceptual research framework

According to Leshem and Trafford (2007:95), a conceptual research framework is a logical tool that an investigator employs to explain the research problem, distinguish

theories and ideas from literature review, design the research and explain the methodology in order to lead to a discussion of findings and conclusions. A conceptual research framework gives a theoretical outline of the purpose of the investigation, and it also guides the investigator to focus on objectives and ensures consistent connections among various activities of the investigation (Leshem and Trafford, 2007:96). Many researchers present conceptual research frameworks in the form of graphic displays. The conceptual framework flow chart of this study is shown in Figure 1.1 and was adapted from Wu, Ruangpan, Sanchez, Rasmussen, Rene and Vojinovic (2021: 3).

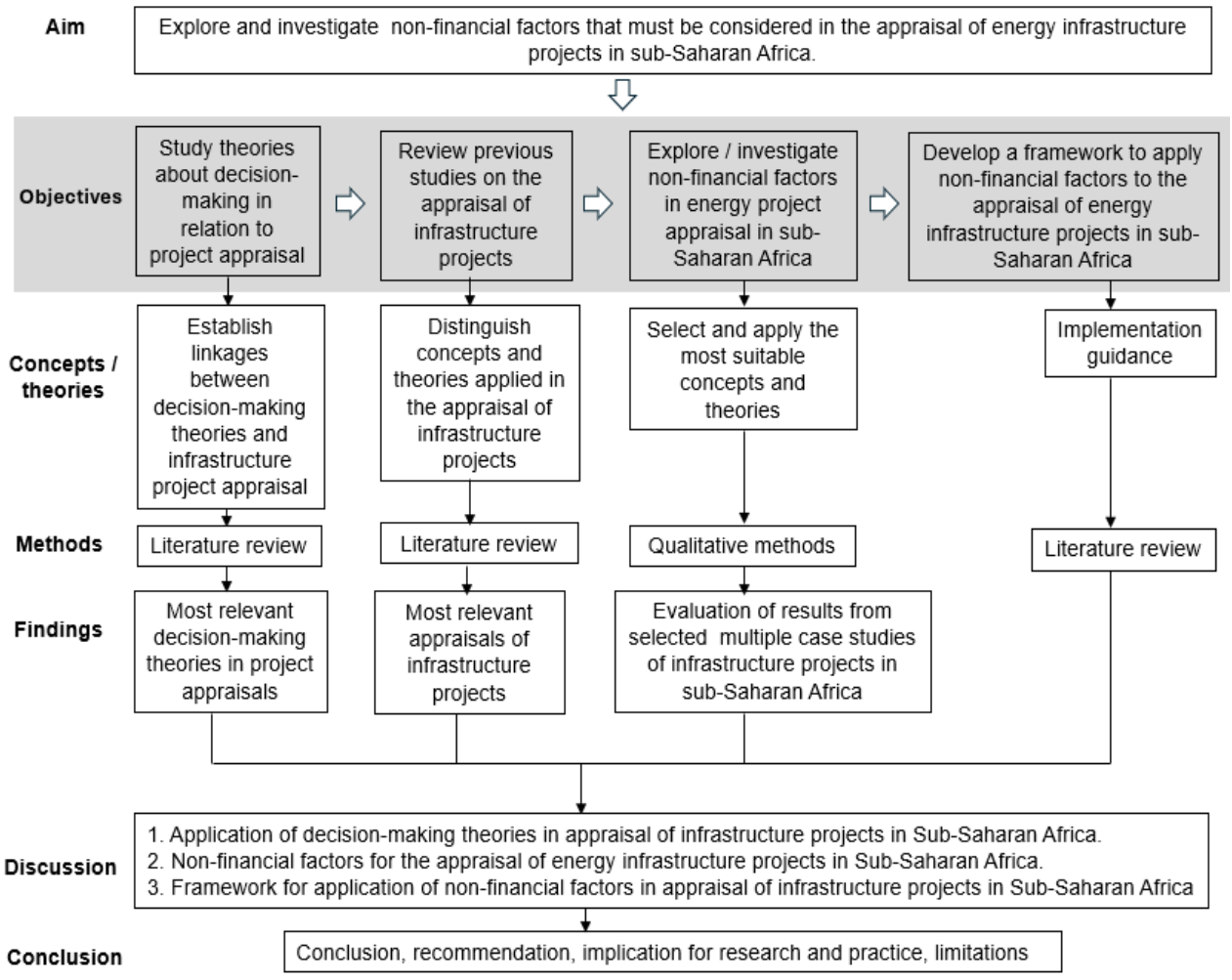

Figure 1.1: Conceptual research framework flow chart

Source: Adapted from Wu et al. (2021:3)

1.9 Structure of this dissertation

This dissertation has been arranged into six chapters, and each chapter focusses on the following:

i. **Chapter 1:** This chapter provides a background to the investigation of energy infrastructure projects in sub-Saharan Africa. It also gives the problem statement and the aims and objectives of the research.

v. **Chapter 2:** This chapter presents a literature review of i) the landscape of infrastructure project appraisal in sub-Saharan Africa, ii) decision-making theories relating to project appraisal, and iii) previous studies on infrastructure project appraisal.

vi. **Chapter 3:** This chapter focusses on the design and methodology of the investigation by looking at methods of data collection, data analysis, data storage, and data presentation. It also describes how the study's validity and reliability were achieved.

vii. **Chapter 4:** This chapter summarises and discusses the data analysis and research findings.

viii. **Chapter 5:** This chapter is the general discussion of findings of the investigation.

ix. **Chapter 6:** This chapter presents the overall conclusions of the investigation and the recommendations. It also proposes a framework for project appraisal that considers non-financial factors. Finally, it declares the limitations of the investigation and proposes areas for further study.

1.10 Conclusion

Chapter 1 presented the background to the investigation of non-financial factors that should be considered in the appraisal of energy infrastructure projects in sub-Saharan Africa. The chapter also laid out the problem statement, aim, and objectives of the investigation. Lastly, the conceptual research framework and overall structure of this dissertation were outlined.

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

This chapter presents the literature review of this investigation. The literature review looks at the landscape of infrastructure project appraisal, decision-making theories relating to project appraisal, and previous studies on infrastructure project appraisal.

2.2 The landscape of infrastructure project appraisal

2.2.1 Shortfalls of financial techniques in project appraisal

Infrastructure projects are usually capital intensive, and in sub-Saharan Africa, many infrastructure projects do not meet the financial viability criteria (Hilmarsson, 2017:58). According to Schwerhoff and Sy (2017:399), many stakeholders are pushing the view that energy infrastructure projects in the developed world should be funded by the private sector because the public sector in many countries in sub-Saharan Africa have constrained resources. Private sector investors are usually not willing to invest in projects that do not pass the financial viability criteria; for example, a net present value equal to or greater than zero in the DCF model indicates that a project will be profitable (Devarajan, Squire and Suthiwart-Narueput, 1997:35; Ofori et al., 2021:1). Project appraisers often use the DCF model to measure the viability of a project because the model is easy to use, although it has many shortcomings (Locatelli, Mancini and Lotti, 2020:252).

Many studies highlighted the shortcomings of the financial techniques used in project appraisals. Meunier, Quinet and Quinet (2014:69) found that changing fundamentals in macroeconomics, market price distortions, and level of business performance affect projects appraised using financial criteria only. Mohamed and McCowan (2001:231) found that errors in forecasting bring a measure of doubt to financial techniques. Typically, a project generates both costs and benefits in its external environment that are hard to forecast financially (Flyvbjerg, 2007:578; Batra and Verma, 2018:81). If the uncertainties are not well managed during the project appraisal, the project may run into problems during implementation. According to Venetsanos, Angelopoulou and Tsoutsos (2002:299), financial DCF models fail to address the dynamic aspects of energy projects,

such as frequent policy changes in the deregulated environment of the energy sector. Furthermore, DCF models do not consider strategic variables, resulting in underestimating the value of an investment (Moutinho and Mouta, 2013:1).

According to Mackie and Preston (1998:6) and Eliasson and Fosgerau (2013:2), “Appraisal optimism” is another shortcoming of the financial methods used for selecting projects. Appraisal optimism occurs when advantages are exaggerated and negative financial impacts are reduced, either knowingly or due to errors in forecasting during project appraisal (Flyvbjerg, 2007:583). Eliasson and Fosgerau (2013:2) further related “appraisal optimism” to “selection bias”, noting that most projects selected based on least cost end up with cost overruns. Flyvbjerg (2007:579) and Prater, Kirytopoulos and Ma (2017:371) stated that optimism bias is a natural human behaviour of giving the future a positive regard, which has often resulted in the unrealistic scheduling of projects.

Hanssen et al. (2020:6) and Devarajan, Squire and Suthiwart-Narueput (1997:35) observed that the non-uniform application of cost-benefit-analysis models is problematic in the appraisal of infrastructure projects. Baptista and Plananska (2017:2) also observed that “an energy system is a complex socio-technical system” that involves multiple stakeholders and long timeframes, and is characterised by technical, economic, political, social, and ecological dimensions. Therefore, the authors concluded that an appraisal of an energy project that focuses only on financial factors is incomplete.

According to Dimitriou, Ward and Dean (2016:7), financial techniques used to appraise projects are guided by the monetisation of attributes based on market performance, yet non-financial factors are policy-driven and do not present themselves to market pricing. Financial conditions may make a project look attractive, but if non-financial factors are inadequately addressed, the project may not surpass challenges and thus fail in later phases (Mohamed and McCowan, 2001:232; Moutinho and Lopes, 2011:3; Batra and Verma, 2018:81).

Financial methods of project appraisal are easier to use, while non-financial factors are not easy to quantify and evaluate (Moutinho and Mouta, 2011:205). Lopes and Flavell (1998:223) and Mohamed and McCowan (2001:232) observed that non-financial factors are usually earmarked for consideration after the project has already been selected. Hanssen et al. (2020:6) observed that investors do not apply a common procedure of appraising projects when considering non-financial factors. According to Mota and

Moreira (2015:1572), successful implementation of public-private partnership (PPP) projects hinges on non-financial factors. They recommended that, in future, studies should be conducted to “explore new variables of a political, legal, macroeconomic and even cultural nature” that affect the implementation of PPP projects. Picking out strategic and environmental factors, Batra and Verma (2018:100) recommended that more deliberation is necessary on non-financial factors during project appraisals to increase the viability and success of projects. Diener and Habisch (2021:296) observed that the current challenge for investors is how to understand the combination of financial and non-financial aspects when making investment decisions.

2.2.2 The viewpoint of development finance institutions and public sector funding

Most infrastructure projects in sub-Saharan Africa that bring universal advantages, including environmental protection, increased peace and stability, and alleviation of energy poverty, attract support from international development finance institutions (DFIs), such as the World Bank (Baptista and Plananska, 2017:2; Tarekegne and Sidortsov, 2021:2). According to Schwerhoff and Sy (2017:394), the main objective of DFIs is to reduce inequality in the world. DFIs have access to capital from international sources and are willing to finance the preparation or implementation of selected infrastructure projects. Financing terms are bilaterally or multilaterally negotiated in advance with affected governments, and can be soft loans or donations (Ojo, 2021:102–105; Mutezo and Mulopo, 2021:2). DFIs can also be guarantors for those countries that financiers see as having high financial, political, policy, regulatory, currency, and/or credit risks (Ndulu, 2006:230; Eberhard et al., 2017:391; Ojo, 2021:109).

However, DFIs do not accept all projects for financing. Each project proposal is individually evaluated by the relevant financial institution, and a decision is made on whether to finance the project wholly, partially, or not at all. According to Gottschalk (2016:288), the World Bank presented new stricter specifications on transparency, and social, environmental, and gender equity matters in project appraisals. Several projects do not qualify to receive financial support from the World Bank. To adequately benefit from DFIs, project practitioners in sub-Saharan Africa should seriously consider non-financial factors in the preparation of energy infrastructure projects.

According to Tarekegne and Sidortsov (2021:2), DFIs dictate their own terms for project appraisals, yet oftentimes these terms do not respond to the specific requirements of developing countries and put “human centred concerns as external assumptions” in decision-making. From 2010 to 2017, an aggregate of US$ 22.5 billion in funding was provided to the power sectors of many sub-Saharan countries, yet it did not result in the expected increase in number of households provided with electricity (Tarekegne and Sidortsov, 2021:2). According to Ika (2015:1112), a study by McKinsey-Devex found that 64% of energy projects that received financing from international development institutions, including the World Bank, did not meet their set objectives by 2011; this was mainly because the non-financial aspects of the projects were inadequately addressed.

Slowly, most non-financial aspects of energy infrastructure projects in sub-Saharan Africa are being escalated to national programmes. Many countries in sub-Saharan Africa have strengthened their regulatory requirements around the implementation of infrastructure projects by focusing more on non-financial aspects. Consequently, many appraisers of energy infrastructure projects, especially politicians and representatives of international DFIs, bring forward non-financial factors as required conditions for funding projects (Gottschalk, 2016:288).

Many energy infrastructure projects are big and make a considerable impact on the economy of a country and the social life of the population. Traditionally, governments prepare energy infrastructure projects since they have the responsibility to safeguard or improve the socio-economic development of citizens (Devarajan, Squire and Suthiwart-Narueput, 1997:35; Ndulu, 2006:233). But, many public sectors, especially in sub-Saharan Africa, do not have adequate capital to finance infrastructure projects (Kalitsi, 2003:15; Tarekegne and Sidortsov, 2021:2). Africa’s infrastructure needs, including energy infrastructure, are between US$ 130 billion and US$ 170 billion per year, and the shortfall is between US$ 67.6 billion and US$ 107.5 billion per year (Ojo, 2021:106). According to Eberhard et al. (2017:391) and Tarekegne and Sidortsov (2021:2), all governments in sub-Saharan Africa, with the exception of South Africa, Botswana, and Mauritius, have limited budgets and are rated as risky for investment by the private sector. A new innovative way for these governments is to team up with the private sector to prepare, execute, and operate a project in a win-win set-up, commonly called PPPs (Grimsey and Lewis, 2002:108; Mota and Moreira, 2015:1564; Vuorinen and Martinsuo, 2019:752).

Several studies showed that projects implemented by the public sector are more likely to fail than projects implemented by the private sector (Ikejemba and Schuur, 2020:1498). The public sector has two main advantages in PPPs: 1) the much-needed socio-economic development projects are financed; and 2) the projects are prepared and implemented professionally by adequate and advanced skills from the private sector, thereby delivering maximum value to all stakeholders (Ndulu, 2006:230; Osei-Kyei and Chan, 2015:1335; Vuorinen and Martinsuo, 2019:752). Simone and Bazilian (2019:20) recommended that besides offering financial support, DFIs should also offer technical assistance in the form of capacity building in project implementation.

Implementing energy infrastructure projects in sub-Saharan Africa is a challenge because of the risk perception of financiers and the inadequate financial capacities of governments (Mungai, Ndiritu and Da Silva, 2022:1). Eberhard et al. (2017:390) studied the financing and performance of PPP projects and observed that countries that have benefited from PPP had the following strong points: Adequate preparation, clear procurement methods, and a stable legal sector. Energy infrastructure projects in sub-Saharan Africa have the potential to destabilise national economies if they go into cost overruns (Flyvbjerg, 2007:583). Therefore, energy infrastructure projects that do not secure funding from DFIs or private investors are oftentimes abandoned by their respective governments to avoid fiscal distress.

According to Haselip, Desgain and Mackenzie (2015:78), non-financial factors introduce good or bad impacts on both the internal and external environment of the project. Therefore, they should be covered in the criteria for selection and acceptance of a project. Moutinho and Mouta (2011:205) also observed that non-financial factors are critical to the success of a project and should be addressed during the project preparation phase. According to Lopes and Flavell (1998:223), a project may pass stringent financial and technical viability criteria at the appraisal stage but still fail because of non-financial factors. Barry, Steyn and Brent (2011:2846) noted that World Bank energy projects in sub-Saharan Africa had a failure rate of 36%, which they attributed to an inadequate understanding of the factors necessary for the selection and acceptance of energy projects in the context of sub-Saharan Africa. According to Ika, Diallo and Thuillier (2012:105), about half of the infrastructure projects that received funding from the World Bank did not meet their objectives. Little and Mirrlees (1990:358) found that the World Bank relied on financial methods during project appraisals. As such, in the 1970s and

1980s the projects did not improve socio-economic challenges as expected. Most financiers, including DFIs, have now incorporated non-financial factors in the appraisal and viability of infrastructure projects, especially those concerning social and environmental responsibilities (Ojo, 2021:102; Diener and Habisch, 2021:295).

Mansell and Philbin (2020:44) supported the notion that the success of an energy infrastructure project should be measured on a triple bottom line value of economic, environmental, and social impacts. They called for the promotion of models or frameworks that incorporate non-financial factors to measure the success of a project, such as the Balanced Score Card (BSC), Social Return on Investment (SRON), Environmental Full Cost Accounting (EFCA), Total Societal Impact (TSI), and Creating Shared Value (CSV). These have been introduced by various consulting groups or organisations but are not yet popular.

2.3 Decision-making theories relating to project appraisal

2.3.1 Multi-criteria decision analysis

Project appraisal is essentially a decision-making process (Moutinho and Mouta, 2013:1). According to Wang and Ruhe (2007:83), decision-making is “one of the basic cognitive processes of human behaviours by which a preferred option or a course of actions is chosen from among a set of alternatives based on certain criteria”. Energy infrastructure projects, as part of energy systems, are not just technical systems but socio-technical systems embedded in various institutions (Baptista and Plananska, 2017:2). Energy infrastructure projects are ordinarily specified to resolve contradictory challenges in various areas at the same time, and cover political, economic, environmental, social, cultural, technological, and institutional aspects (Flyvbjerg, 2007:579; Ward, Dimitriou and Dean, 2016:22). The appraisal of infrastructure projects is not just a financial activity but also requires considering multiple non-financial factors of a behavioural and organisational nature (Moutinho and Mouta, 2013:2). A few decision-making theories have been studied and discussed by various researchers, and one of them is the theory of multi-criteria decision analysis (MCDA). The MCDA theory states that a decision taken should satisfy multiple stakeholders, and therefore, it is not necessarily the best decision but a reasonable decision (Guitouni and Martel, 1998:501). MCDA is implemented by bringing in as many stakeholders as possible, together setting the selection criteria in

advance, and obtaining marks from all selection participants on wide range of aspects of the project (Guitouni and Martel, 1998:501; Ward, Dimitriou, and Dean, 2016:22). In MCDA, appraisers can assign mathematical weights and scores to various measurable aspects of the project and then calculate overall ratings (De Nooij, 2011:3097). In the MCDA process, the problem to be solved is discussed and ways to resolve it are proposed and evaluated. Based on inputs from the appraisal team, an aggregate score is assigned to each resolution, and the highest scored decision is implemented (Guitouni and Martel, 1998:501; Ward, Dimitriou and Dean, 2016:22; Zlaugotne et al., 2020:1).

MCDA can apply various methods, such as Multi-objective Optimisation on the Basis of Simple Ratio Analysis (MOOSRA), elimination and choice expressing the reality, and Analytic Hierarchy Process (AHP) (Dey, 2006:92; Zlaugotne et al., 2020:1). Figure 2.1 shows a typical MCDA/AHP process. In the AHP, top level actions represent the overall objective, middle level actions represent elements affecting decisions, and low-level actions represent decision options (Dey, 2006:92). For project appraisals everywhere and not just in sub-Saharan Africa, the extreme point decision (the goal) is normally to abort the project, accept it for implementation, or pend it for future consideration.

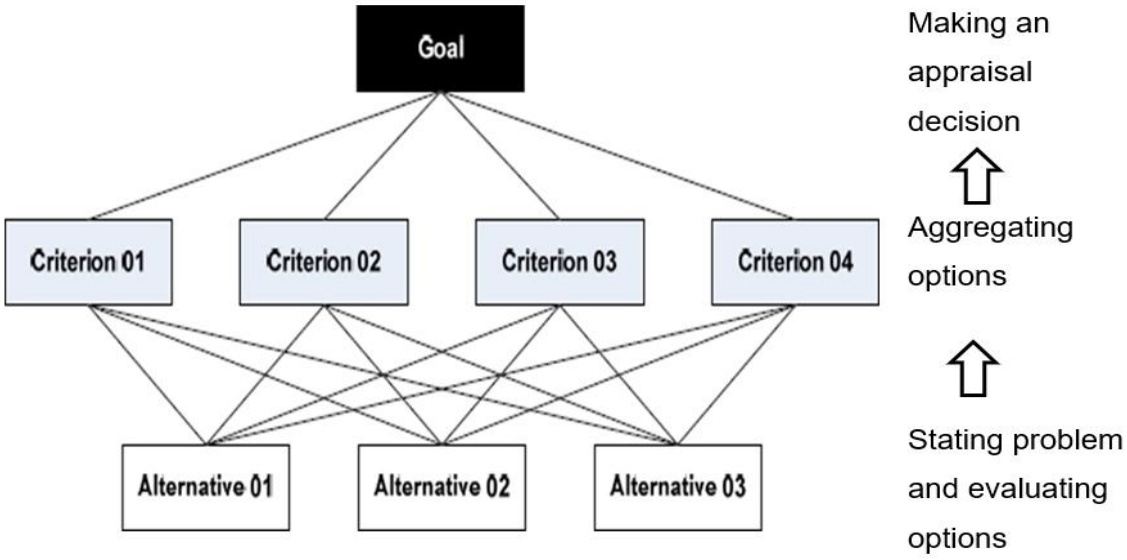

Figure 2.1: Typical MCDA and AHP process

Source: Adapted from Dey (2006)

According to Baumli and Jamasb (2020:5), the application of MCDA methods has been enriched by the development of computerised mathematical tools. This investigation scrutinised the prevalence of the MCDA theory. Energy infrastructure projects in sub-

Saharan Africa span across multiple sectors and involve multiple stakeholders, and MCDA allows for multiple inputs from multiple stakeholders and can lead to a satisfactory decision-making process.

2.3.2 Descriptive and normative theories of decision-making

Wang and Ruhe (2007:74) rendered two paradigms for decision-making theories, namely the normative theory and the descriptive theory. Decisions made after applying rigorous quantitative methods are categorised under the descriptive theory, whereas decisions "made rationally based on preferences and certain axioms" are categorised under normative theory, according to Wang and Ruhe (2007:74). Wang and Ruhe presented the following four strategies for decision-making:

i. The intuitive strategy based on preference and common sense;
ii. The empirical strategy based on experience and experiments;
iii. The heuristic strategy that uses principles and ethics; and
iv. The rational strategy based on minimum cost, maximum utility, and minimum risk.

These strategies are useful when applying non-financial factors in project appraisal.

2.3.3 The possibility and the probability theories of decision-making

Two other theories of decision-making are the possibility theory and the probability theory. Mohamed and McCowan (2001:231) designed a framework for applying both financial and non-financial aspects of project appraisal using the possibility theory. They observed that most probabilistic models of project appraisal ignore non-financial aspects because they are not easy to measure. This challenge is amplified when many stakeholders are involved, and many options are considered at the same time. The possibility theory is preferred to the probability theory in large technical projects in which subjectivity cannot be avoided in some decisions (Mohamed and McCowan, 2001:233).

Masini and Menichetti (2013:514) went beyond technical and economic attributes of energy systems in their study of the measure of consideration of non-financial factors in appraising renewable energy projects. They proffered the social and psychological theory of decision-making. According to the social and psychological theory, decisions are affected by people's theoretical beliefs formed by cognitive and cultural factors. These factors include personal history, educational background, and previous experience.

Baumli and Jamasb (2020:2) added that the “extent of institutional pressure, knowledge about operating context and attitude towards radical innovation” are some of the factors which affect decision-making. Moutinho and Lopes (2011:22) found that project appraisal decisions in a firm depended on the educational qualifications and experience of the Chief Executive Officer (CEO). Moutinho and Mouta (2013:7) noted that the risk attitude and tenure of office of the CEO also influence investment decision-making. For energy infrastructure projects in sub-Saharan Africa, government officials and politicians are key stakeholders, and they often apply the social and psychological theory of decision-making.

2.3.4 Institutional isomorphism

Masini and Menichetti (2013:515) proffered another theory of decision-making called institutional isomorphism. According to the authors, institutional isomorphism is broken down into coercive isomorphism, which is pressure to conform to legal obligations in decision-making; normative isomorphism, which is pressure from management or the community in decision-making; and mimetic isomorphism, which is pressure from evidence of proven success of a similar decision. Institutional theory in decision-making also encompasses pressure from peer firms, consultants, or available information from technical reports. Masini and Menichetti (2013:515) found that institutional pressure from peers, consultants, and technical information is some of the factors that influence firms in Europe to finance renewable energy projects. Funding for many projects in sub-Saharan Africa is provided by external organisations, notably the World Bank and AFDB. These banks have laid down criteria for accepting a project, and project appraisers should abide by the criteria.

In appraisal of infrastructure projects, there is likely to be pressure to conform to legal obligations and pressure to take recommendations from external consultants. A lot of technical reports have been composed by consultants about the feasibility of energy infrastructure projects in sub-Saharan Africa. Flyvbjerg (2007:583) found that at times, project planners are under political pressure for a project to pass the appraisal and source funding, and so they under-estimate costs and amplify benefits. In typical government set-ups, the legislative arm usually puts pressure on the executive arm to implement energy infrastructure projects. Therefore, the institutional isomorphism theory is very

typical and relevant in the appraisal of energy infrastructure projects in sub-Saharan Africa.

2.3.5 The real options theory of decision-making

Investment in energy projects is characterised by irreversibility, uncertainty, and time flexibility (Santos, Soares, Mendes and Ferreira, 2014:589; Danylyshyn et al., 2019:2696). Deregulation of the energy sector and the liberalisation of electric energy trading have exacerbated the problem of uncertainty in the nature of energy infrastructure projects (Ceseña, Mutale and Rivas-Dávalos, 2013:576). Traditional financial DCF models for project appraisal are not flexible towards future uncertainties of energy projects, which include changes in market variables and changes in operating strategies (Santos et al., 2014:589).

According to Flyvbjerg (2007:579), large infrastructure projects are complex, and their scopes change considerably over time. There is one theory about investment decision-making that can address uncertainties and allows for flexible decision-making, namely the real options (RO) theory (Locatelli, Mancini and Lotti, 2020:252). This theory proffers that a project scope can be altered in line with the changing environment to minimise risks and maximise profits (Ceseña, Mutale and Rivas-Dávalos, 2013:574). When applying the RO theory, managers are empowered to make flexible decisions pertaining to, for example, starting time, operating regime, or sizing of projects based on new information in the project environment (Venetsanos, Angelopoulou and Tsoutsos, 2002:297; Santos et al., 2014:589; Locatelli, Mancini and Lotti, 2020:252; Ofori et al., 2021:2). For example, delaying an investment provides an opportunity to gather new information and assess the maturity of the technology, and this is one way to minimise uncertainties and reduce risks.

According to Flyvbjerg (2007:579), another problem with large infrastructure projects is that often the technology of the project is not standard. Applying the RO theory, Venetsanos, Angelopoulou and Tsoutsos (2002:299) and Ofori et al. (2021:2) noted that deferring, partially decommissioning, or even abandoning a project are real options that usually add extra value to the investor. Thus, the RO theory was developed to address uncertainties in the project environment (Ceseña, Mutale and Rivas-Dávalos, 2013:575; Locatelli, Mancini and Lotti, 2020:252).

Traditional methods of project appraisal based on financial factors do not consider uncertainties. The RO theory uses the financial tools of project appraisal and enriches the investment decision based on the changing environment. Ceseña, Mutale and Rivas-Dávalos (2013:578) critically reviewed the application of the RO theory on energy generation projects, and they found that there is a general misunderstanding and limited knowledge about the application of the RO theory, and yet it can be used to increase the value of projects. Applying the RO theory may enrich project appraisal decisions in the dynamic environment of sub-Saharan Africa.

2.3.6 The agency theory of decision-making

The agency theory addresses the following two problems that can occur in a principal-agent relation: i) The principal and the agent may hold conflicting interests or different preferences; and ii) the principal may not have the capability to verify what the agent is doing (Eisenhardt, 1989:58). According to Moutinho and Mouta (2013:1), a project appraisal can be conducted by people who have their own personal interests at heart, and in addition, a project appraisal may be based on information that is provided by people with a hidden agenda who are hiding important information. According to the agency theory, investment decisions are usually distorted by the difference in knowledge between the agent and the principal arising from conflicts of interest or moral hazards (Moutinho and Mouta, 2013:2). The agency problem also manifests in information misalignment between company management and the project manager. Improving information sharing and providing adequate incentives are some of the ways to minimise the agency problem (Moutinho and Mouta, 2013:3). To minimise personal bias, decision-making should be supported by a standard framework that demands a systematic collection and analysis of data from all possible sources (Lopes and Flavell, 1998:230). The application of the agency theory can assist in reducing corruption in the appraisal of energy infrastructure projects in sub-Saharan Africa.

The decision-making theories that were reviewed in this section are summarised in Table 2.1.

Table 2.1: Summary of decision-making theories

No.	Theory	Basis of evaluation	Attribute of decision	Citations
1	MCDA/AHP theory	Multiple options and criteria to consider at various stages that involve multiple stakeholders	The option with best scores is chosen	Ward, Dimitriou, and Dean (2016:22); Zlaugotne et al. (2020:1)
2	Descriptive theory	Based on empirical or experimental results or experience	Decision is made objectively	Wang and Ruhe (2007:74)
3	Normative theory	Based on preferences, axioms, common sense, principles, and ethics	Decision is intuitive and rational	Wang and Ruhe (2007:74)
4	Possibility theory	Assigns a possibility value to each parameter or evaluation element	Degree of subjectivity in the decision	Mohamed and McCowan (2001:233)
5	Probability theory	Applies financial models	Objective decision	Mohamed and McCowan (2001:233)
6	Social and psychological theory	Theoretical beliefs, previous experience, and educational background	Cognitive decision	Masini and Menichetti (2013:514)
7	Institutional isomorphism	Pressure to conform to legal requirements and demands from management or community, and pressure from peer firms and consultants	Coercive and normative decision	Masini and Menichetti (2013:515)
8	RO	Comparison with prevailing practical scenarios, e.g. how about deferring, partial de-commissioning, or abandoning the project?	Flexible decision to cater for changing environment	Ceseña, Mutale and Rivas-Dávalos (2013:574); Locatelli, Mancini and Lotti (2020:252)
9	Agency theory	Conflicting agenda between stakeholder and agent, moral hazard, hidden agenda, and hiding information	Decision is tilted towards preferences of the agent	Moutinho and Mouta (2013:3); Baumli and Jamasb (2020:2)

2.4 Review of previous studies on infrastructure project appraisal

Moutinho and Lopes (2011:22) used a questionnaire survey to study the impact of non-financial factors on investment decisions for projects implemented by the 1 000 largest Portuguese firms. They found that firms considered non-financial factors to varying degrees, and that the considerations depended on the industry, size of the firm, size of the project, educational qualification of the CEO, tenure of office of the CEO, and educational qualification of the project manager.

Using exploratory qualitative research design, Castanho et al. (2018:93) studied critical success factors for cross border development projects in Europe. The authors used multiple case studies, interviews, and surveys. They noted that master plans, transparent politics, and the desire to promote international connectivity were critical for the success

of these projects. In similar research, Osei-Kyei and Chan (2015:1344) reviewed studies on critical success factors of PPP projects published from 1990 to 2013. The authors found that in those 23 years, the top five critical success factors were non-financial, and were “risk allocation, strong private consortium, political support, community or public support, and transparency in procurement”.

Vuorinen and Martinsuo (2019:751) studied the influence of stakeholders on the success of infrastructure projects using a qualitative research design with multiple case studies. The multiple case studies design was aimed at minimising distortion and increasing generalisability of the findings. They established that stakeholder influence is driven by the expected value from the project. Specific to infrastructure projects, they found that public value with a strong bearing towards non-financial aspects is prominent. These large infrastructure projects form a socio-technical system that involves multiple stakeholders, and their success mainly hinges on the value given to the public.

Mota and Moreira (2015:1563) applied quantitative techniques to study “the importance of non-financial determinants” for PPPs in Europe. They learned that a conducive macroeconomic environment, robust legal system, and previous PPP experience are crucial for the successful delivery of these projects. PPP projects require strong legal agreements with various stakeholders, such as the suppliers, off-takers, and private equity holders. Thus, a robust legal system was regarded highly in PPP project appraisal.

Song et al. (2020:529) investigated the implementation of the proposed Grand Inga Hydropower scheme, and discovered that political, economic, and technical factors are critical in the feasibility of energy infrastructure projects. For assessing the viability of an intra-regional or inter-regional power transmission line, they developed a project appraisal model that focused on the following six main dimensions: Social economy, situation of infrastructure, development of electricity market, tariff competitiveness, condition of the transmission route, and potential for development. Grand Inga is a large energy project likely to have a big impact on the economy of the implementing countries, and it was thus important to consider political and economic factors in the appraisal of this project.

Barry, Steyn and Brent (2011:2845) investigated factors affecting the appraisal of renewable energy technologies in Africa using multiple case studies in Malawi, Tanzania, and Rwanda. They determined 13 non-financial factors of project appraisal that fall under

the following broad categories: Technology, site appropriateness, economics and finance, achievability of the implementing organisation, government support, and environmental factors.

Ikejemba and Schuur (2020:1498) investigated why renewable energy projects funded by the public sector fail in sub-Saharan Africa by examining 29 small-scale renewable energy projects in the following sub-Saharan countries: Malawi, Ethiopia, Mozambique, Tanzania, South Africa, Gabon, Kenya, Ghana, and Nigeria. Many of the projects were implemented by the governments and included hospitals, offices, schools, and streetlights, while a few were off-grid electric systems. Within 18 months, 17 projects were no longer operational, while nine were only partially operational. Shortcomings in the following non-financial factors were identified as reasons for the failures: Knowledge transfer, technology, politics, tendering process, public acceptance, community involvement, and expertise.

Tarekegne and Sidortsov (2021:1) evaluated the criteria employed by DFIs that fund energy projects in sub-Saharan Africa. They discovered that even though the institutions help improve electrification, their standards for electrification planning perpetuate inequalities in the region. Furthermore, they found that dependence on financial criteria in the electrification programmes brought inequalities among societies benefiting from the energy project life cycle.

Lopes and Flavell (1998:223) investigated non-financial factors in the appraisal of large projects in companies, and they found that application guidance was limited. They therefore developed a framework to identify, analyse, and evaluate non-financial factors. The factors they identified were strategic and synergistic, technical, political, social, environmental, organisational and managerial, and legal.

Batra and Verma (2018:80) investigated the level to which firms in India apply non-financial criteria in project appraisals and established that the majority conduct technical, economic and social feasibility studies by applying Strength-Weakness-Opportunity-Threat (SWOT) analysis. The authors identified the following non-financial factors as being critical to project viability: “technical factors, stakeholders’ expectations, social factors, strategic alignment and external factors”. At corporate level, top management is more concerned about meeting business objectives, and therefore, the strategic intent was considered as important in the appraisal. Technical, organisational and managerial,

and legal aspects also strongly contributed because top management wanted the projects to succeed. The social and environmental aspects were also considered because most corporates have committed to social and environmental responsibilities.

Baptista and Plananska (2017:7) investigated the various energy access programmes in sub-Saharan Africa implemented by DFIs. They found that the initiatives considered economic and environmental concerns but lacked the broader socio-technical approach required by energy systems. They identified the following non-financial factors as being critical to the success of the initiatives: Availability of an educated workforce, labour market, economic empowerment, and social instability. The initiatives they looked at included Power Africa, Lighting Africa, and Africa-EU Energy Partnership. Using interviews and questionnaire surveys, Diallo and Thuillier (2004:29) studied the perception of project coordinators on the success approach of donor-funded projects in Africa, and they concluded that each stakeholder assessed the success of the project based on their own interests.

Masini and Menichetti (2013: 510) investigated the extent to which firms consider non-financial factors when investing in renewable energy projects in Europe. They found that the following non-financial factors contribute to project appraisal: Confidence in the effectiveness of existing policies, confidence in adequacy of technology, institutional pressure from peers, consultants and technical information, technological awareness, and expertise in operation of renewable energy plants. Most renewable energy projects are green-field projects, meaning they are implemented for the first time, and it was thus prudent to use mixed qualitative and quantitative methods in this research. Non-financial factors such as adequacy of technology, existing policies, and availability of information were critical in the project appraisal.

Lastly, Ofori et al. (2021:7) appraised a large utility-scale renewable energy project in Ghana using RO theory. Considering market, economic, and technological factors, they found that delaying the implementation of the project by four to eight years in an uncertain environment provided an optimum solution and extra value to the investor.

2.5 Conclusion

Various authors highlighted the deficiency of energy infrastructure in sub-Saharan Africa. It was also evident that the traditional techniques of project appraisal based on financial

techniques do not guarantee the success of energy infrastructure projects. Even though literature on non-financial factors for project appraisal is limited, the many shortfalls of the financial techniques of project appraisal have been highlighted in the existing literature. The project appraisal process is about decision-making, and theories about decision-making are used to make these decisions. These theories include the possibility theory, the MCDA theory, the RO theory, and the agency theory. The review of previous studies highlighted the need to seriously consider non-financial factors in project appraisal in sub-Saharan Africa. Many of these empirical studies used mixed methods and multiple case studies research designs.

This chapter presented a review of the literature on i) the landscape of infrastructure project appraisal in sub-Saharan Africa, ii) decision-making theories relating to project appraisal, and iii) previous studies on infrastructure project appraisal. The next chapter presents the research methodology of the current investigation.

CHAPTER 3
RESEARCH METHODOLOGY

3.1 Introduction

This chapter describes the research paradigm, design, and approach of this investigation, including the data collection and analysis. The actions taken to comply with research ethics and to achieve research reliability and validity are also presented in this chapter.

3.2 Research paradigm

A research paradigm is the worldview or philosophical framework, including method, model or pattern, that the researcher uses to plan, construct, conclude and report a study (Junjie and Yingxin, 2022:10; Rahi, 2017:1; Rehman and Alharthi, 2016:51). A paradigm is set of ideas or beliefs that assist the researcher and other researchers to comprehend theories and practices of the research work, and to carry out research in a legitimate and reasonable manner (Cohen, Manion and Morrison, 2018:8). A suitable research paradigm establishes the foundation of the research and improves the relevance, quality, and validity of the research (Alharahsheh and Pius, 2020:40).

3.2.1 Kinds of research paradigms

There are three main kinds of research paradigms. The first is positivism. Positivists believe that there is only one truth that can be ascertained and understood. Positivists take a rigorous approach to quantify this reality, normally using scientific methods and experiments (Rehman and Alharthi, 2016:53, Golafshani, 2003:598).

The second type of research paradigm is interpretivism. Scholars of interpretivism believe that there are numerous realities (Junjie and Yingxin, 2022:10; Rehman and Alharthi, 2016:55). According to Rahi (2017:1), scholars of interpretivism aim to understand human behaviour in the process of gaining knowledge of reality. They believe that the complex nature of human behaviour affects research results.

The third type of research paradigm is critical theory. Supporters of the critical theory believe that reality exists but is affected by social factors such as politics and religion (Rehman and Alharthi, 2016:57).

Each of the above research paradigms is built on three philosophical pillars: ontology, epistemology, and methodology. The theory of ontology states that there is one single reality in nature that is measurable and observable. The theory of epistemology guides how knowledge of reality can be gained in a logical and valid manner. The theory of methodology refers to general concepts, methods and paths applied in discovering and presenting the reality (Alharahsheh and Pius, 2020:40; Cohen, Manion and Morrison, 2018:3; Rahi, 2017:1, Rehman and Alharthi, 2016:51–52, Gichuru, 2017:2).

3.2.2 The research paradigm and its assumptions

i) Research paradigm

The research paradigm chosen for this investigation was interpretivism. According to Alharahsheh and Pius (2020:43), the interpretivist paradigm enables researchers to seek and establish deep knowledge through investigating experiences and perceptions of a particular social context. In agreement, Rahi (2017:1) stated that scholars of the interpretive paradigm believe in the exploration of the environment they live in and seek to comprehend it thoroughly. Based on their experiences and understanding, interpretivists give meaning to things of the world. Hence, according to Gichuru (2017:2), the key knowledge interest of interpretivism is deep understanding, and not prediction. Rahi (2017:1) further argued that the qualitative research paradigm is actually the interpretive paradigm, also called constructivist paradigm. According to Gichuru (2017:1), the real world, affected by human construction, has multiple attributes that cannot be quantified; therefore, reality can only be socially constructed through language, consciousness and shared meanings. The interpretivist research paradigm is suitable in the exploration and comprehension of real-world phenomena affected by human behaviour (Rehman and Alharthi, 2016:55–56). Therefore, the interpretivist paradigm was the most suitable for this research.

ii) Research assumptions

This research made the following philosophical assumptions based on the chosen interpretivist paradigm:

- *Ontology:* This research aimed to explore non-financial factors of project appraisal. Project appraisal is carried out by human beings, and stakeholders of projects are human beings. Because of the unpredictable nature of human behaviour, there

are multiple realities perceived through inter-subjectivity to understand the phenomena under study. The ontological assumption made in this research was multiple realities perceived through inter-subjectivity.

- *Epistemology:* Epistemology deals with the synthesis of objectivity and subjectivity in social research, also called observer inter-subjectivity (Mascolo, 2017:43). According to Mascolo (2017:43), there are three aspects of objectivity in scientific research: i) publicly observable phenomena, ii) lack of bias, and iii) "accurate representation of the world as it truly is". However, it is not easy to detach the researcher and research participants from what is being researched from reality (De Jaegher, 2016:393). In social research, understanding of what is being observed varies according to the observer's pre-knowledge and psychological inclinations. According to De Jaegher (2016:393), by participating in an investigation, the observer's experience and what is being observed change. This is qualitative research on a social system. Thus, the epistemological assumption of the research is that all degrees of subjectivity may not be eliminated, but subjectivity was minimised by the stringent research methodology applied.
- *Methodological:* The methodology applied in this research was qualitative research. To increase research validity and reliability, multiple case studies were used, and a triangulation method was applied to the findings. The total number of case studies was three. According to Gichuru (2017:1), triangulation minimises subjectivity in research. Similar studies presented in the literature review followed the same qualitative methodological approach. In qualitative research where data is obtained through face-to-face interviews, interactional problems may occur (Roulston, 2014:277). But in this research, secondary qualitative data were obtained from official databases of credible international organisations; there were no interviews.

3.3 Research design

3.3.1 Exploratory research

This study was based on an exploratory research design as it complied to the following three criteria of exploratory research (Bhattacherjee, 2012:5):

i. It was conducted in a new area of enquiry;

ii. Its main purpose was to pursue and discover new insights (i.e. about how non-financial factors are used to appraise energy infrastructure projects in sub-Saharan Africa); and,
iii. The result of the research may lead to detailed studies on the subject matter in future.

3.3.2 Qualitative research

This investigation employed qualitative research methods. According to Berg and Lune (2012:12), unlike quantitative research designs that focus on numerical measures, qualitative research designs refer to “meanings, concepts, definitions, characteristics, metaphors, symbols, and descriptions”. Golafshani (2003:600) stated that qualitative research is suitable for understanding phenomena in real-world settings that are difficult to explore using statistical methods. Osei-Kyei and Chan (2015:1344) found in studies similar to the current investigation published between 1990 and 2013 that the most adopted research design was qualitative studies that use case studies and questionnaire surveys. According to Rashid et al. (2019:8) and Thomas and Magilvy (2011:152), the main aim of qualitative research is to explain events or phenomena and not to generalise the findings to a group of cases. This is in line with the adopted interpretivism research paradigm described above.

3.3.3 Multiple case study design

This investigation employed a multiple case study design. Vuorinen and Martinsuo (2019:753) states that key advantages of the multiple case study design are enhanced reliability, high probability of replication, and vigour of the study. A multiple case study design is convenient to replicate and compare contexts (Baxter and Jack, 2008:548; Bhattacharjee, 2012:40; Tomaszewski, Zarestky and Gonzalez, 2020:2).

Vuorinen and Martinsuo (2019:753) also used a multiple case study design to study stakeholder influence on infrastructure projects. They found the following as benefits of the multiple case study design: Improvement in the generalizability, replication, robustness, and versatility of the findings. According to Gustafsson (2017:11), a multiple case study design facilitates a wider discovery of evidence and leads to more convincing conclusions. Gustafsson (2017:11) further states that in a multiple case study design, the

researcher can analyse data across different situations and understand differences and similarities among the three cases.

3.4 Research approach

3.4.1 Data collection from case studies

(i) Secondary sources: In this investigation, qualitative data were obtained from secondary sources. According to Rubin and Babbie (2005, cited in Berg and Lune, 2012:12), “secondary sources are documents written or objects created by others that relate to a specific research question or area of research interest”. The secondary data sources of this investigation were the official online databases of the World Bank (2021b) and the AFDB (2021), which were chosen because these institutions are key financiers of energy infrastructure projects in sub-Saharan Africa, and they keep project data records in the public domain. Both organisations have supported multiple energy infrastructure projects over many decades. According to Tarekegne and Sidortsov (2021:3), from 2010 to 2017, 40% of energy sector financing in sub-Saharan Africa was provided by the World Bank, and 27% came from the AFDB. The project data records in the World Bank (2021b) and AFDB (2021) official online databases have project appraisal reports, project procurement plans, environmental and social impact assessment reports, and project closure reports. Baptista and Plananska (2017:3) investigated initiatives for energy access provision in Africa. Barry, Steyn and Brent (2011:2845) investigated critical factors in the appraisal of small-scale renewable energy projects in Africa, and both collected data from the same official World Bank online database for their studies. The following sub-section explains why these secondary data were chosen.

(ii) Documents in the case study research design: Collecting secondary qualitative data from documents chosen as case studies is a common method of data collection in the case study research design (Tomaszewski, Zarestky and Gonzalez, 2020:2). Tarekegne and Sidortsov (2021:5) investigated injustices in the implementation of electrification projects supported by the World Bank and also used World Bank project appraisal documents as case studies. They noted that project appraisal documents composed by the World Bank are comprehensive, and the project documents include strategic context, project development objectives, project description, implementation, key risks, appraisal summary, results framework, and monitoring. The appraisal summary covers “economic

and financial, technical, procurement, social, environment, and grievance redress" aspects (AFDB, 2009; AFDB, 2011, World Bank, 2018). The contents of the AFDB project documents are similar to those of the World Bank, and include basic project information, project objectives, key project risks, and project appraisal results. Vuorinen and Martinsuo (2019:753) also used a document-based data collection approach to study stakeholder influence on infrastructure projects.

(iii) Number of cases in a multiple case study design: Determining the number of cases to study in a multiple case study design requires prudent consideration because the population is not clear and the boundary of the unit of analysis is difficult to define. A small number or even one case is adequate for the case study design (Baxter and Jack, 2008:545; Yin, 2013:321). Yin (2003:388) stated that the typical sampling logic is irrelevant in a multiple case study design. The researcher is at liberty to choose the number of case replications. Guetterman and Fetters (2018:5) stated that the selection of the number of cases may be guided by the aim of the research and the research question.

Barry, Steyn and Brent (2011:2846) used three case studies in their investigation of selection criteria for renewable energy technologies in Africa. The current investigation also used three case studies. The robustness of the outcome was improved by selecting three case studies that factored in diversity in terms of i) location (regions of sub-Saharan Africa, namely Southern Africa, Eastern Africa and Western Africa); ii) purpose (generation and transmission projects); and iii) institutions appraising the energy projects (World Bank and AFDB).

3.4.2 Data analysis

(i) Coding: Secondary qualitative data are usually in the form of large amounts of information. Coding is the identification, highlighting, and labelling of important elements in qualitative data to prepare it for analysis (Linneberg and Korsgaard, 2019:259). In this investigation, the researcher used both deductive and inductive methods of coding. An initial list of codes was generated from the theoretical concepts taken from literature consulted (deductive coding). However, most codes were generated from the data that were investigated (inductive coding). According to Williams and Moser (2019:45), coding is a crucial operation in qualitative research as it groups data into patterns and guides the data analysis in an organised manner.

(ii) Software package: Data obtained from the energy project case studies were organised and stored in Microsoft Word and Microsoft Excel. The content analysis, codification, organisation into categories, quantification of the categories, and graphical presentation of the data were done using the specialised qualitative analysis software package, *QDA Minor Lite.*

(iii) Content analysis: Content analysis is the examination of text data and classification of specific terms or categories so as to derive meaning from the data (Gichuru, 2017:4). The content analysis approach introduced by Berg and Lune (2012:181), as presented in Table 3.1, were adopted. Baptista and Plananska (2017:3) used a similar approach in their qualitative data analysis.

Table 3.1: Model of content analysis of qualitative data

Step	Activities
1	Identify research question
2	Determine analytic categories (sociological constructs)
3	Read through data and establish grounded categories (open and axial coding)
4	Determine systematic (objective) criteria for selection for sorting Determine categories of data for analysis
5	Begin sorting the data into the various categories Revise categories or selection criteria if necessary, after several cases have been completed
6	Count the number of entries in each category for descriptive statistics and to allow for the demonstration of magnitude Review textual materials as sorted into various categories seeking patterns (Remember, no apparent pattern is a pattern)
7	Consider the patterns in light of relevant literature and/or theory (show possible links to theory or another research) Offer an explanation (analysis) for the findings Relate the analysis to the extant literature on the subject

Source: Adapted from Berg and Lune (2012:181)

(iv) Inductive reasoning: Findings from the data analysis were captured and formatted in tables and figures for further interpretation and exhibition. These findings are argued while considering the theory presented in the main research report using the inductive reasoning approach.

3.5 Research reliability

In the positivist way of thinking, research reliability is increased when the research methods can be repeated and lead to the same results on different occasions (Kaman and Othman, 2016:356). Reliability in research aims to eliminate errors and biases (Yin, 2003:387). However, bias cannot be completely avoided from both the researcher and

the research participant in qualitative research (Tomaszewski, Zarestky and Gonzalez, 2020:2; Baxter and Jack, 2008:544), but the subjectivity inherent in a researcher can be minimised by applying methods like triangulation (Gichuru, 2017:2). According to Bush (2002:59), the meaning of reliability may vary depending on the stance of the researcher. The stringent consideration of replication to determine research reliability is held by the positivist research paradigm, commonly applicable in quantitative research design. The chosen direction of this investigation was the interpretive research paradigm, commonly applicable in qualitative research. Great effort was made to improve reliability, as explained below.

Firstly, the main source of data was secondary data from documents. According to Bush (2002:64), it is very difficult to introduce bias in documented data because documented data were collected for other purposes and are in a permanent form. Therefore, using the same methodology, it will be easy for another researcher to replicate findings from documented data.

Secondly, research reliability is increased by employing different sources (Cresswell, 2013:251; Kaman and Othman, 2016:355). Thus, by applying a multiple case study design, reliability was increased. Triangulation criteria was used when analysing the findings and making conclusions from the multiple cases. According to Gichuru (2017:1), careful application of triangulation significantly minimises researcher biasness. Gustafsson (2017:11) stated that although not a guarantee, evidence gathered from multiple cases is sturdier and more reliable evidence gathered from only one case; however, Gustafsson (2017:11) warned that increasing the number of cases may lead to less observation time.

Thirdly, rigour, professionalism, and the credibility of the researcher are important to ensure the reliability of qualitative research (Golafshani, 2003:601). The steps for content analysis are presented in Table 3.1, and the overall research methodology is summarised in chart format in Figure 3.1. The research design was adopted from similar credible, published studies.

Lastly, the entire research process was documented in a comprehensive report. Formal presentation is one way of improving reliability (Baxter and Jack, 2008:554). The research methodology is presented clearly in this chapter for other researchers to repeat (replicate) and obtain the same findings from the same case studies.

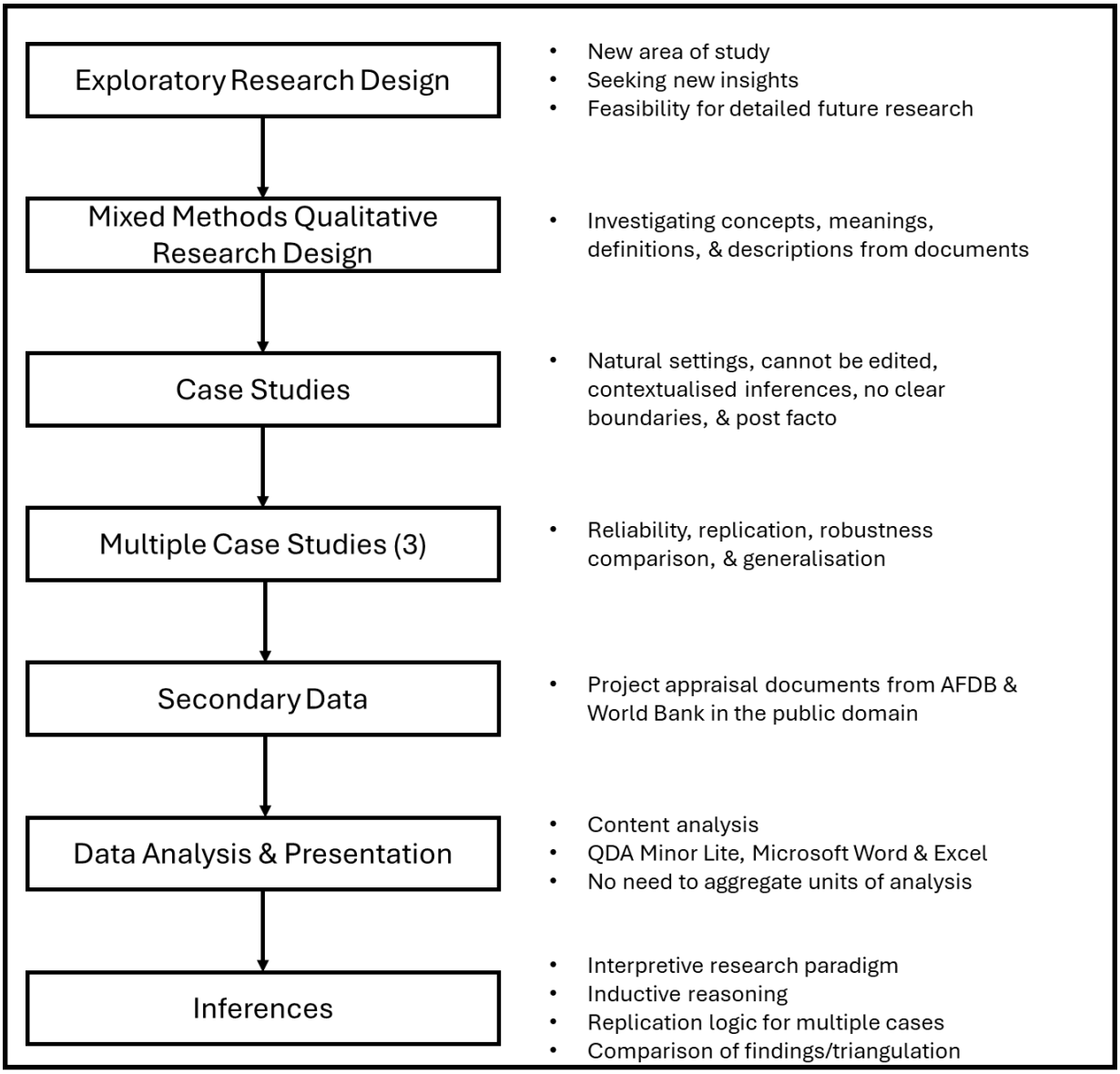

Figure 3.1: Research methodology flow chart

3.6 Research validity

Research validity is classified into internal and external validity. According to Kaman and Othman (2016:355), internal research validity concerns the clarity of the research context and the alignment of the research methodology, findings, and conclusions to the objectives of the research. Chapter 1 of this dissertation presented a clear background to this research and the problem statement. Replication logic was used to establish a chain of evidence from the multiple case studies. *QDA Minor Lite* tools were used to carry out pattern-matching on the data obtained from multiple case studies. The data analysis and findings were linked to the problem statement, and the conclusions focus on the

objectives of the study. All these steps contributed towards improving the internal validity of this investigation.

External research validity “relates to the extent that findings may be generalised to the wider population which the sample represents, or to the similar settings” (Bush, 2002:67). Absolute external validity is commonly applicable in quantitative research in the positivists research paradigm. According to Yin (2013:324), the case study design is generally weak in external validity. This study followed the interpretivism research paradigm, and therefore, external validity was increased using multiple case studies and applying triangulation, in which data from multiple sources were cross-checked (Kaman and Othman, 2016:351, 353).

3.7 Data validity

In research, to avoid unreliable insights or unreliable findings, it is critical to guarantee that the research data are accurate, reliable, and of high quality. The data should meet the criteria specified in the research methodology. Databases should be of high integrity. Data validity is achieved when the data measure what it is designed to measure (Golafshani, 2003:599). There are the following main types of data validity:

i. *Content validity*: The data should cover all aspects of interest of the research context (Delgado-Rico, Carretero-Dios and Ruch, 2012:450);
ii. *Criterion-related validity*: The data should tally with the research purpose;
iii. *Construct validity*: The data should capture the targeted complexity of the phenomena or characteristics of the construct under study; and
iv. *Face validity*: At face value, the data should look valid.

In this research, data validity was achieved in many ways. Firstly, the data represented the real-world construct. The appraisal documents were composed for real-life projects by renowned organisations, the AFDB and the World Bank. At face value, the data were valid.

Secondly, the integrity of the source databases was not questionable. Many researchers, including some presented in the literature review of this research, have used these databases for their research projects. The databases are maintained and updated regularly. The owners of the data declared their commitment to accuracy of the data. This addressed face validity and gave assurance of data integrity.

Thirdly, the research data, in form of project documents, were checked to verify that they covered the complete information about project appraisal by subject-matter experts in project management at Southern African Power Pool Coordination Centre. The project documents covered all information of interest, including project concept, description, objectives, location, participants and key players, stakeholders, and costs. This addressed both content validity and construct validity.

Fourthly, the data were in text format. This was fitting well for the specified content analysis criterion.

Lastly, these data were qualitative in nature, and were secondary data, which means the data were not collected specifically for this research. Thus, there was little or no likelihood of altering the data and introducing any strategic errors. Also, downloading the data was simplified, and it was not necessary to trim any data. Thus, data accuracy at collection was guaranteed.

3.8 Data analysis

A set of texts from interview transcripts or documents is a common form of qualitative research data. There are two main methods of analysing this type data: i) thematic analysis, and ii) content analysis. In thematic analysis, the researcher obtains the data, examines the data, and identifies common themes that come out of the data. Content analysis is similar to thematic analysis in the steps taken (Vaismoradi, Jones, Turunen and Snelgrove, 2016:101) because, according to Morgan (2022:2088), thematic analysis was developed from content analysis. In content analysis, the researcher examines the qualitative data, identifies the presence of certain words, groups the words into coding categories, and quantifies them to analyse the presence of meanings, relationships and concepts (Vaismoradi, Turunen, and Bondas, 2013:400–401). While content analysis deals with organised identification of data and filtering into groups, thematic analysis deals with the identification and establishment of common ideas and subjects in the qualitative data (Vaismoradi, Turunen, and Bondas, 2013:400–401). Vaismoradi et al. (2016:102) observed that themes are subjective and require interpretation, whereas coding categories are explicit content of text. In this study, the researcher employed content analysis for the following reasons: i) All the research data obtained were in the form of text; ii) it was easier to link the pattern of coding categories to the targeted non-financial factors of investment decision-making; and iii) the software tool used, *QDA*

Minor Lite, had strong capabilities of coding, quantifying, and reporting coding categories. Apart from *QDA Minor Lite*, Microsoft Excel and Microsoft Word software packages were used for data storage, analysis, and reporting.

3.9 Research ethics clearance

The ethical issues of this research were addressed in different ways. Firstly, during the project proposal, the researcher applied for ethics clearance from the University. The proposal was reviewed, and ethics clearance was granted according to the University policy. Refer to Appendix E for the ethics clearance certificate of this investigation. Secondly, the case study data for this investigation were collected from the public domain, namely the official websites of the World Bank (2021b) and AFDB (2021). These institutions put data, including project appraisal data, in the public domain for researchers and other stakeholders to use the data without adverse impacts on the owners or sources of the data. Thirdly, the researcher developed a research data management plan and implemented it according to the requirements of the University. In particular, ethics clearance issues were addressed by making the data for this research private and protecting it with a password. In addition, the data can only be retrieved by the researcher and the assigned academic research supervisor.

3.10 Case study selection

For the case study method, a small number or even a single case can serve the research purpose (Yin, 2013: 321; Baxter and Jack, 2008:545). Yin (2003:377,388) added that the typical sampling logic is irrelevant in case studies and that it is up to the researcher to choose the number of case replications. According to Gustafsson (2017:11), the choice of the number of cases may be guided by how much is known and how much new information is sought. Vuorinen and Martinsuo (2019:765) focused only on three infrastructure projects. This study also used three chosen case studies, presented in Table 3.2.

Table 3.2: Selected case studies for this investigation

No.	Case, case date	Project name (project type)	Project location	Project appraiser	Document location reference
A	Project appraisal document, November 2011	Menengai Geothermal Power Plant (generation)	Kenya, East Africa	AFDB	AFDB (2011)
B	Project appraisal document, June 2018	Guinea and Mali Power Interconnection (transmission)	Guinea and Mali, West Africa	World Bank	World Bank (2018)
C	Project appraisal document, September 2009	Morupule B Coal-fired Power Plant (generation)	Botswana, Southern Africa	AFDB	AFDB (2009)

3.11 Conclusion

This chapter explained the research design and approach applied in the investigation. The methods for data collection and data analysis were presented. The chapter also outlined the actions taken to obtain research ethics clearance and to ensure the reliability and validity of the findings. In the upcoming chapter, the research findings are presented and discussed.

CHAPTER 4
DATA ANALYSIS AND FINDINGS

4.1 Introduction

In this chapter, the research data are analysed, and the research findings are presented.

4.2 Data analysis

4.2.1 Determination of coding categories of non-financial factors

Firstly, the researcher determined broad categories of non-financial factors using deductive reasoning based on previous studies and the literature consulted. Secondly, documents of the case studies were studied thoroughly. Then, the researcher found many codes under each category of non-financial factors by inductive reasoning while doing the content analysis of the cases. Table 4.1 shows the findings of the coding process.

Table 4.1: Findings of the coding exercise

Category for non-financial factors	Codes for non-financial factors
Strategic and synergy	Fit into goals, part of national resource plans
	Synergy with current activities
	Long-term benefits
	Support from DFIs
	Reliability, security, and equity of energy supply
	Regional integration and cooperation
	Diversification of generation and economy
	Contribution to UN SDGs
	Increase access to electricity
	Economic benefits or least cost solution
Technical	Maturity of technology
	Appropriateness of technology
	Technology innovation
	Physical scale, layout, and location
	Availability of engineering and technical services
	Availability of technical skills
	Resource availability
	Technical experience in similar projects
	Renewable and clean sustainable energy
	Readiness of transmission network
	Local and international expert counsel

Category for non-financial factors	Codes for non-financial factors
Legal	Robustness of legal framework
	Commitments of contracts
	Transparency and corruption prevention laws
Social	Impact on minorities or communities
	Impact on human settlement
	Land tenure and use
	Adequacy of compensation schemes
	Enhancement of local economic activities
	Gender equality and child protection
	Poverty reduction and employment creation
	Human immunodeficiency virus/acquired immunodeficiency syndrome ((HIV)/AIDS) management
	General social impact consideration
Environmental	Air, water, and noise pollution
	Protection of endangered species
	Health and safety of communities
	Mitigation of emission of greenhouse gases
	General environmental impact consideration
Organisational and managerial	Project and functional structure
	Project management arrangements
	Criteria for monitoring and evaluation of the performance of the project
	Lessons from any pilot project and past experience
	Qualification and experience of technical and managerial teams
	Readiness of implementing agency
Political	Political commitment and sensitivities
	Government guarantee or support
	Government relations with international institutions
	Public image

As part of content analysis using the *QDA Minor Lite* software tool, the occurrences of these codes in each case study were counted and analysed.

4.2.2 Content analysis of all case studies

A comprehensive content analysis was performed on the case study documents using *QDA Miner Lite* and Microsoft Excel. Non-financial factors for project appraisal were identified, codified, and categorised by applying qualitative data analysis techniques on the project appraisal documents. The occurrence of each code in the appraisal document as a paragraph or a phrase was counted. The numbers of codes and categories in all case studies were analysed. Vuorinen and Martinsuo (2019:756–757) used a similar coding framework in their study on stakeholder influence on infrastructure projects.

Appendix A contains the detailed findings of the content analysis of the study cases. A total of 592 codes of different categories were identified in the three case studies. Due to limited space, the discussions of findings in the case studies in this chapter focussed on the categories of these codes.

4.3 Case Study A: Menengai Geothermal Power Project by AFDB

4.3.1 Attributes of the Menengai Geothermal Power Project

The appraisal document of the Menengai Geothermal Power Project was officially composed and signed off by the AFDB in November 2011. According to AFDB (2011), the project was located in Kenya, about 180 km north-east of Nairobi, in the Great African Rift Valley. Figure 4.1 shows the geographical location of the project. According to the AFDB, the project was planned for completion by July 2016 and would cost about US$ 502.2 million. The objective of this project was to produce geothermal steam to generate 400 MW of electric power.

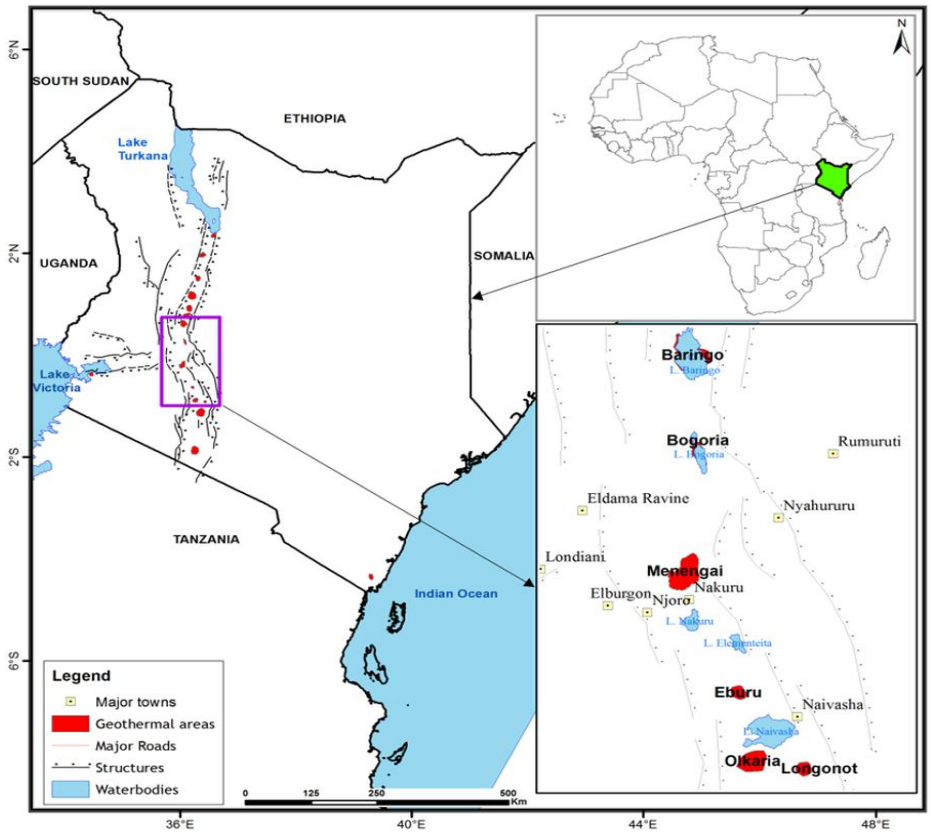

Figure 4.1: Location of the Menengai Geothermal Power Project

Source: AFDB (2011)

4.3.2 Findings: Menengai Geothermal Power Project

Due to limited space, the discussions of findings in the case studies in this chapter focuses on the categories of these codes. Table 4.2 shows the coding categories of non-financial factors that occurred in the Menengai Geothermal Project case study. The coding category that obtained the highest score (28.3% of total code occurrence) was 'strategic and synergy'. The project was in line with the government strategy of reducing poverty and creating employment. Deficiency in power generation had affected several sectors of the Kenyan economy, and thus, the project would contribute towards a reliable and secure energy supply. The project would enhance local economic activities and instil active participation by the private sector, thereby creating jobs. After commissioning, communities, businesses, and industries would benefit from affordable and clean power.

Table 4.2: Codes per category for the Menengai Geothermal Power Project case

No.	Coding category of non-financial factors	Code count	Percentage (%)
1	Strategic and synergy	60	28.3
2	Social	41	19.3
3	Technical	38	17.9
4	Environmental	30	14.3
5	Political	19	8.9
6	Organisational and managerial	15	7.1
7	Legal	8	3.7
	Total	**211**	**100**

The coding category that obtained second highest score (19.3% of total code occurrence) was 'social'. Unskilled jobs would be given to the local community members to reduce poverty, and the project would improve quality of life and gender equality. Any adverse social impact, like HIV infection, were assessed and mitigated. The coding category that obtained the third highest score (17.9% of total code occurrence) was 'technical'. The project implementers had adequate technical experience in similar projects, and technical skills and engineering services were locally available. The technology employed was mature.

The coding category that obtained the fourth highest score (14.3% of total code occurrence) was 'environmental'. Geothermal is an environmental-friendly and renewable source of energy, and assessments showed that the project would lead to a reduction of close to 2 million tonnes of carbon dioxide (CO_2) emissions per annum when

commissioned. The main concerns were clearance of vegetation and the contamination of soil and water by chemicals in the drilling fluids. All potential negative environmental impacts were identified and studied. Mitigation measures, such as water recycling and re-forestation, were planned.

The coding category that obtained the fifth highest score (8.9% of total code occurrence) was ‘political’. The Kenyan government provided a guarantee to the project funding, and the government maintained good relations with the international institutions.

The coding category that obtained the sixth highest score (7.1% of total code occurrence) was ‘organisational and managerial’. The project functional structure and project management arrangements were professionally crafted.

The coding category that obtained the lowest score (3.7% of total code occurrence) was ‘legal’. The legal framework is robust in Kenya, but transparency and corruption prevention were not explained in detail.

4.4 Case Study B: Guinea-Mali Interconnection Project by World Bank

4.4.1 Attributes of the Guinea-Mali Interconnection Project

The second case study of this investigation was the Guinea-Mali Interconnection Project. The appraisal document for this project was officially composed and signed off by the World Bank in June 2018 upon completion of a comprehensive appraisal of the project. According to the World Bank (2018), the project would involve “the construction of a 714 km 225 kV double circuit transmission line from N’Zérékoré in Guinea to Sanankoroba in Mali, as well as the construction of five substations in Guinea”. Figure 4.2 shows the geographical location of the project. According to World Bank (2018), the objective of the project was “to increase the electricity supply in Eastern Guinea, enable electricity trade between Guinea and Mali” and to increase Guinea’s capability to export electricity to Western African Power Pool countries (World Bank, 2018).

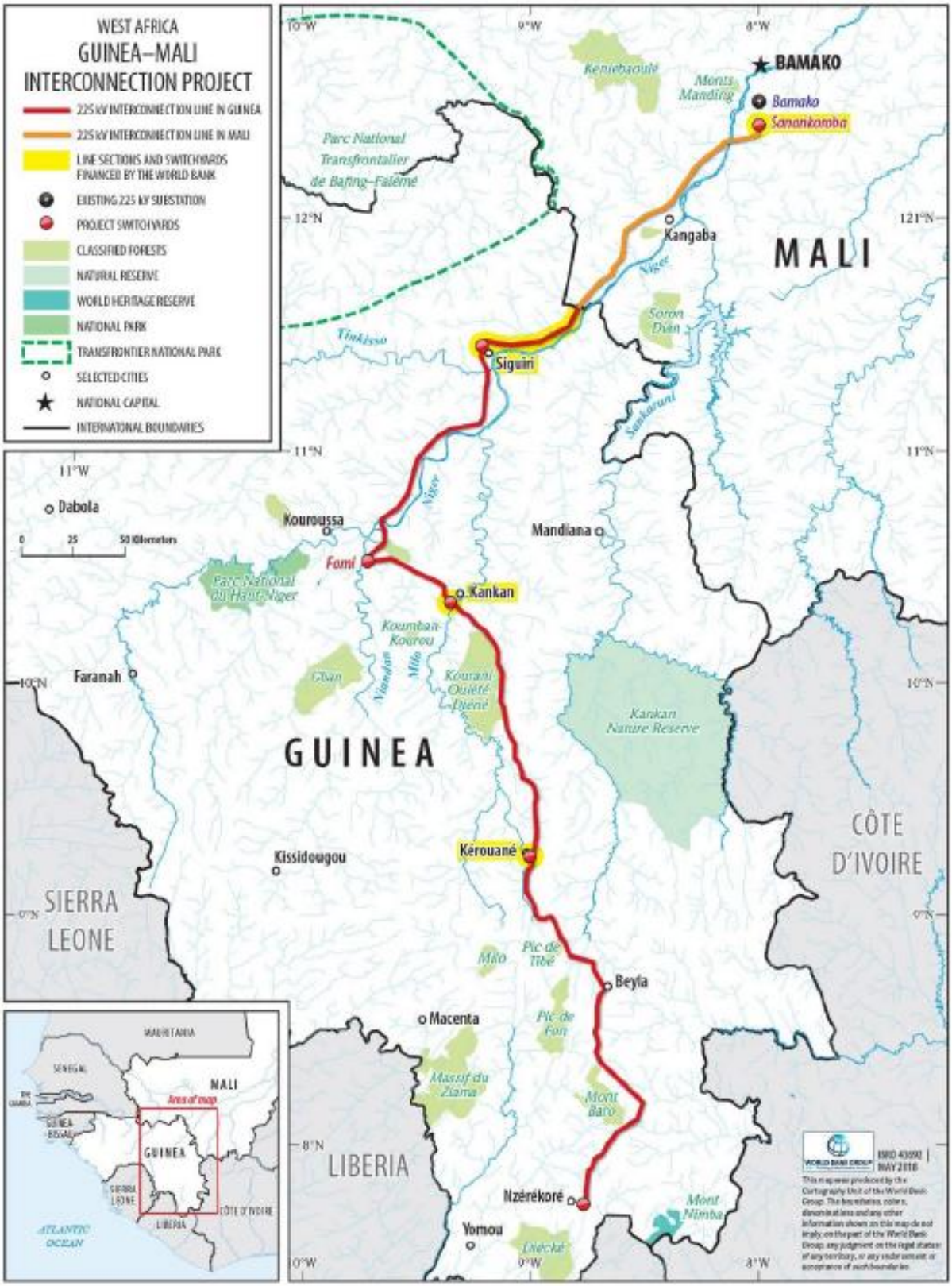

Figure 4.2: Location of the Guinea-Mali Interconnection Project

Source: World Bank (2018)

4.4.2 Findings: Guinea-Mali Interconnection Project

Due to limited space, the discussions of findings in the case studies in this chapter focuses on the categories of these codes. Table 4.3 shows the findings of the content analysis for the Guinea-Mali Interconnection Project. The coding category that obtained the highest score (33.2% of total number of codes) was ‘strategic and synergy’. The interconnector would not only increase electricity trade between Guinea and Mali but would also connect main urban centres in Guinea, thereby increasing access to electricity and economic activities. The project would also enhance regional integration. By integrating the power systems of the two countries, it was assessed that “the average levelised cost of energy would drop from US$ 70 to US$ 64 per megawatt-hour” (World Bank, 2018).

Table 4.3: Codes per category for the Guinea-Mali Interconnection Project case

No.	Coding category of non-financial factors	Code count	Percentage (%)
1	Strategic and synergy	73	33.2
2	Social	45	20.5
3	Organisational and managerial	32	14.6
4	Environmental	30	13.6
5	Technical	22	10.2
6	Legal	11	5.1
7	Political	9	4.3
	Total	**222**	**100**

The coding category that obtained the second highest score (20.5% of total number of codes) was ‘social’. The emphasis was on the improvement of quality of life, gender and child protection, and acceptance of the project by social groups. It was stated that the provision of reliable, clean, and affordable energy would protect women and children from harmful sources of energy and empower them to participate in economic activities. Women would also be trained and hired in various jobs for the project.

The coding category that obtained the third highest score (14.6% of total code occurrence) was ‘organisational and managerial’. Both the governments of Guinea and Mali were well prepared to implement the project. They had already set up project management and reporting structures. It was detailed that project implementation units would be established at the national power utilities of both countries, which were the implementing agencies.

The coding category that obtained the fourth highest score (13.6% of total code occurrence) was ‘environmental’. The environmental impacts were assessed and mitigated. Action would be implemented to protect endangered species and the health and safety of communities.

The coding category that obtained the fifth highest score (10.2% of total code occurrence) was ‘technical’. The transmission network was ready to be integrated, technical skills and services were available, and the technology to be used was mature.

The coding category that obtained the sixth highest score (5.1% of total code occurrence) was ‘legal’. The regulatory institutions were performing well in both countries. The coding category that came last (4.3% of total code occurrence) was ‘political’. Both governments offered guarantees, but the political environment in both countries was unstable because there was a risk of war, revolution, or terror.

4.5 Case Study C: Morupule B Power Plant Project by AFDB

4.5.1 Attributes of the Morupule B Power Plant Project

The third case study of this investigation was the project appraisal document of the Morupule B Coal-fired Thermal Power Plant Project. This document was officially composed and signed off by the AFDB in September 2009 upon completion of a comprehensive appraisal of the project. It stated that the Morupule B Coal-fired Thermal Power Plant Project involved the construction of four generation units, each with a capacity of 150 MW. According to AFDB (2009), the project was located in Botswana in Southern Africa (Figure 4.3). According to the AFDB (2009), the project was planned to be commissioned in mid-2016 at a total cost of US$ 1.405 billion. The AFDB contributed US$ 216.22 million as a loan and US$ 0.931 million as a grant to the government of Botswana. The government of Botswana contributed US$ 205.83 million. The difference was covered by loans from the World Bank and from a commercial bank in Botswana. The objective of the project was to generate sufficient electric power for Botswana. It was noted that by 2008, Botswana was importing over 80% of its electric energy demands, mainly from South Africa. In 2008, South Africa announced that it would reduce power exports to Botswana by 2013. The peak demand of Botswana was projected to reach 600 MW in 2013. The project appraisal assessed several non-financial factors regarding the coal-fired power plant project.

Figure 4.3: Location of the Morupule B Coal-fired Thermal Power Plant Project

Source: AFDB (2009)

4.5.2 Findings: Morupule B Power Plant Project

Due to limited space, the discussions of findings in the case studies in this chapter focuses on the categories of these codes. Table 4.4 shows the findings of coding categories of non-financial factors for the Morupule B Power Plant Project. The coding category that had the highest code occurrence (25.8% of the total code occurrence) was 'technical'. Several studies, including a generation expansion feasibility study by PB Power in 2004, had been carried out by both local and international experts, and they made clear recommendations for the project. Technical skills were readily available because the personnel from the executing agency, Botswana Power Company, were well experienced and knowledgeable in the proposed technology as they had operated and

maintained the old Morupule A power plant. The fuel resource, coal, was also readily available. The power plant would be constructed at the mouth of a coal mine and essential water supply was available. The technology to be employed in the generation and transmission systems was mature and compliant with local standards. The boiler technology selected was said to be suitable for the type of coal at Morupule mine in Botswana.

Table 4.4: Codes per category of the Morupule B Power Plant case

No.	Coding category	Code count	Percentage (%)
1	Technical	41	25.8
2	Strategic and synergy	40	25.2
3	Social	23	14.5
4	Environmental	20	12.5
5	Organisational and managerial	15	9.3
6	Political	13	8.1
7	Legal	7	4.5
	Total	**159**	**100**

The coding category that obtained the second highest score (25.2% of total number of codes) was ‘strategic and synergy’. It was stated in the appraisal document that the project was critical to the socio-economic development of Botswana. At that time, neighbouring South Africa had planned to reduce power exports to Botswana, and Botswana thus planned to achieve self-sufficiency by 2013 and increase its electricity access rate from 47% in 2008 to 80% in 2016.

The coding category that obtained the third highest score (14.5% of total code occurrence) was ‘social’. The project would promote gender and child protection, create employment, and reduce poverty. The planned social compensation schemes were also adequate. Paying out compensation according to the Resettlement Action Plan was set as a condition for loan provision. The management of HIV/AIDS, use of local labour, and enhancement of local economic activities were well planned.

The coding category that obtained the fourth highest score (12.5% of total code occurrence) was ‘environmental’. The main concern was emission of greenhouse gases. It was noted that Morupule B combined with Morupule A would not comply with the minimum limits of greenhouse gas emissions. However, the government of Botswana was committed to implementing a large scale concentrated solar power plant (200 MW) in the near future to offset emissions from Morupule B. It was also stated in the project

appraisal document that electrostatic precipitators and a monitoring system would be installed “to minimise the particulate emissions from the power plant” and monitor emissions (AFDB, 2016).

The coding category that obtained the fifth highest score (9.3% of total code occurrence) was ‘organisational and managerial’. The project implementation unit comprising personnel from the government and the national power utility was already set up. Project management arrangements were set up by the implementing agencies.

The coding category that obtained the sixth highest score (8.1% of total code occurrence) was ‘political’. The government offered a strong guarantee for the project. The government was committed to implementing reforms in the energy sector. The government committed to establishing an energy regulator. The government set aside resources, including money, to meet a great part of the project cost. The government also provided human resources at various government ministries for the project. Relations between the government and international institutions were very strong.

The coding category that came last (4.5% of total code occurrence) was ‘legal’. The government of Botswana was committed to establishing an energy regulator and implementing various reforms in the energy sector. The Electricity Supply Act in Botswana was amended in December 2007. The contract for the supply of coal was ready for signing. The government of Botswana was top in Africa for transparency, good governance, and prevention of corruption.

4.6 Replication and triangulation of findings in the three case studies

Figure 4.4 shows that the ‘strategic and synergy’ factors were the most prevalent in the three case study studies, followed by ‘social’ factors. ‘Technical’ and ‘environmental’ factors had almost equal scores, and came third in the Menengai and Guinea-Mali projects. However, in the Morupule B project ‘technical’ factors were as high as ‘strategic and synergy’ factors. ‘Political’ and ‘organisational and managerial’ factors were prevalent in all three cases, but higher in the Guinea-Mali project. However, ‘legal’ factors had the lowest number of occurrences in all three cases. It was observed that the non-financial factors of project appraisal were generally replicated in three cases.

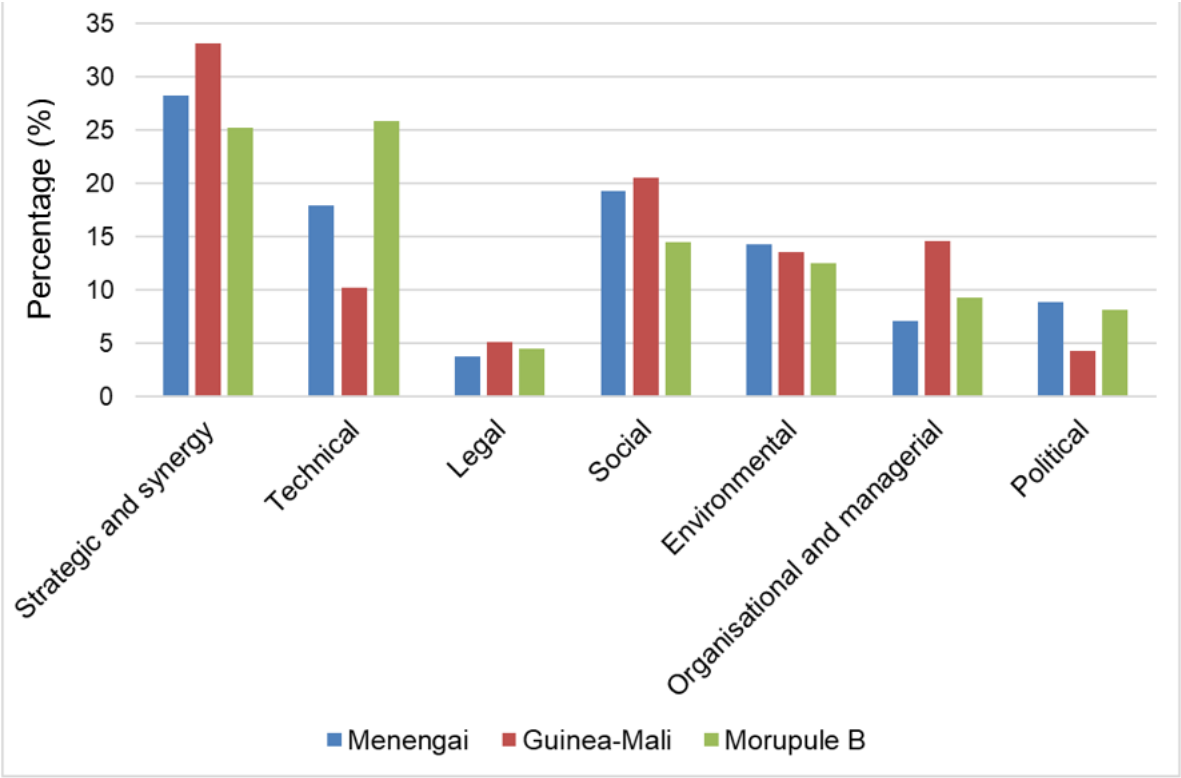

Figure 4.4: Percentage of occurrence of coding categories per project

Considering individual codes, the distribution of the top 10 occurrences is shown in Table 4.5, and it shows that five of the seven coding categories are represented in the top 10 list. This pointed to the need to consider multiple factors in appraisals by using methods such as MCDA. Appendices A–D present more details on the distribution of coding categories among the three case studies.

Table 4.5 focuses on the number of occurrences of individual codes. For example, it states the number of occurrences of 'increase access to electricity' as a code. This code is in the category of 'strategic and synergy'. Differently, Figure 4.5 shows the findings on the broad categories.

Table 4.5: Codes per category for all study cases

No.	Coding category	Code	Menengai	Guinea-Mali	Morupule	All
1	Social	Gender equality and child protection	6	15	7	28
2	Strategic and synergy	Increase access to electricity	6	13	7	26
3	Strategic and synergy	Reliability, security, and equity of energy supply	11	7	7	25
4	Environmental	Mitigation of emission of greenhouse gases	8	4	12	24

No.	Coding category	Code	Menengai	Guinea-Mali	Morupule	All
5	Environmental	General environmental impact consideration	13	7	3	23
6	Organisational and managerial	Readiness of implementing agency	1	14	8	23
7	Political	Government guarantee or support	7	5	11	23
8	Strategic and synergy	Fit into goals, part of national resource plans	11	3	8	22
9	Strategic and synergy	Regional integration and cooperation	2	15	2	19
10	Social	Poverty reduction and employment creation	14	2	3	19

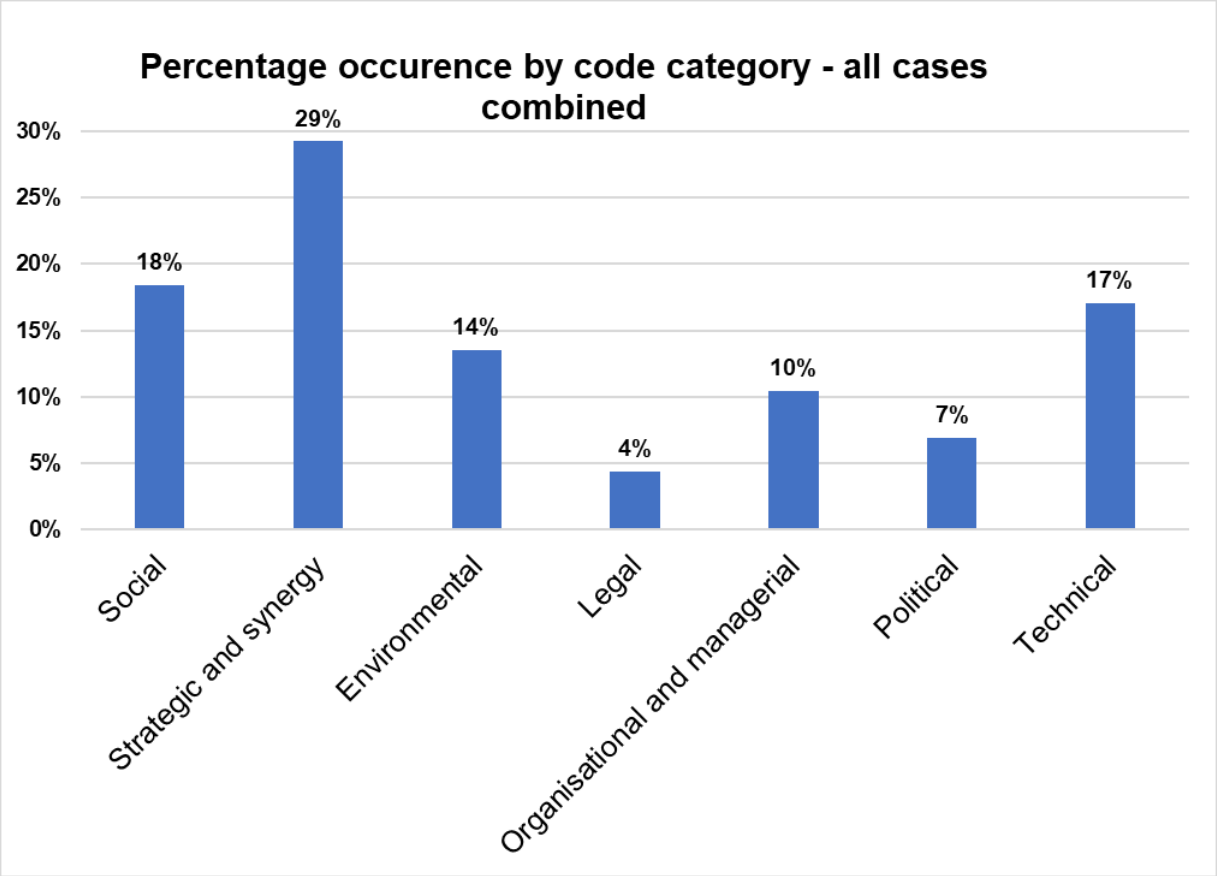

Figure 4.5: Percentages of occurrence of coding categories for all projects

The category with the highest percentage of occurrence in all cases was the strategic and synergy category, followed by the social category. The social category scored 18% occurrence, slightly higher than the third placed category, the technical category, with

17%. The lowest, with 4% of occurrence, was the legal category, followed by the political category with 7%.

4.7 Conclusion

This chapter explained the data analysis approach and presented the research findings. In the next chapter, the findings and the whole investigation are discussed.

CHAPTER 5
DISCUSSION

5.1 Consideration of non-financial factors in project appraisal

The World Bank and AFDB are renowned DFIs with access to large capital. One of their primary aims is to enhance equality in the world. These DFIs follow a rigorous project appraisal process. The three projects studied in this investigation passed the appraisal by the DFIs because they generally demonstrated strong consideration of non-financial factors. Strategically, the three projects were the national socio-economic development plans, and had great support from their respective governments. There was synergy between the project plans and other national economic agendas. Relating to organisational and managerial factors, the nominated implementing agencies at national level demonstrated readiness and capacity to implement the projects. In the case studies, environmental and social impact assessments were carried out by reputable and experienced firms. Measures to mitigate adverse impacts of the projects on the environment, such as reduction of emission of greenhouse gases (GHGs), were identified. Under the technical category, the proposed technologies of the projects were mature, and providers of technical skills and services were identified. Politically, the projects were accepted by local groups, international institutions, and national governments.

In Guinea and Mali, the possibility of political revolutions was highlighted as a weak point, but the interconnection project was highlighted as one measure of bringing integration and unity to the affected regions. National legal frameworks were mainly assessed for establishment, transparency, corruption prevention, respect of the rule of the law, and regulation of the energy sector. Project management organisations were also checked in the appraisal to ensure smooth implementation. The projects' compliance with the agendas of the DFIs was mainly measured through non-financial factors. DFIs have an agenda to develop the socio-economy of sub-Saharan Africa in a sustainable and environmentally friendly manner. Addressing non-financial factors in the identified seven categories (strategic and synergy, technical, environmental, social, legal, organisational and managerial, and political) gave the DFIs confidence that the projects would be successfully implemented.

Several key players were mentioned in the appraisal documents of the three study cases, namely donors, financiers, DFIs, project developers, project owners, consultants, governments, energy regulators, civil society, non-governmental organisations, and implementing agencies. The local communities and the general public were also identified as key stakeholders in the inception and entire life cycle of energy infrastructure projects in sub-Saharan Africa. However, they marginally influenced the appraisal process compared to financiers. Financiers had the greatest influence on the appraisal of the energy infrastructure projects, followed by politicians.

Table 4.5 presents the counts of individual codes. It was found that individual codes from five of the seven categories featured in the top ten list. The highest number came from the social category, followed by the strategic and synergy category. Individual codes from the legal category and technical category did not feature in the top ten list. This could be attributed to the low number of codes in this category. Right from the coding exercise, the legal category received three codes, the lowest number of codes, and these were robustness of legal framework, commitments of contracts, and transparency and corruption-prevention laws. The content analysis approach was uniformly applied to all codes. Hence, the occurrence of codes in the legal category was the lowest. Considering individual codes, the technical category also did not feature in the top ten (see Table 4.5). But, as shown in Appendix A, the technical category took position 13 and all positions from 18 to 22. In general, the occurrence of codes in the technical category was very significant in all cases because power generation and transmission projects apply technology.

The findings of the further analysis of categories of non-financial factors are presented in Tables 4.2, 4.3 and 4.4. For the generation projects (Menengai and Morupule B), the following categories were in top three positions: Strategic and synergy category, social category, and technical category. In the transmission project (Guinea-Mali), the only difference was that the technical category was displaced by the organisational and managerial category. This was attributed to the difference in technical complexity between generation and transmission projects. Generation power plants are more complex than transmission equipment. The legal category had the lowest percentage occurrence, followed by the political category. The possible explanation for this is that legal and political matters in these projects were handled at a high level in the appraisal process. The DFIs (World Bank and AFDB) had the objective of assisting developing

countries and were guarantors of many of the contracts for the projects. In the case study documents, the legal and political matters are explained a more concise manner than the other categories.

5.2 Replication and triangulation of findings

The three case studies were different in many areas, including geographical location, technologies, transmission versus generation, and size. It was found that the need for regional integration and cooperation occurred more in the transmission interconnection project than in the power plant projects. For the Guinea-Mali Interconnection Project, the project investors and project owners were more interested in the improvement of the quality of life and economy of the local populations, and hence, the occurrence of codes in the social category were more prevalent than other categories. In the Menengai Geothermal Power Plant Project, the project owners and investors were more interested in diversifying and increasing electric power generation, increasing use of clean electric energy, and stimulating the growth of small to medium businesses and industries in Kenya. In the Morupule B Power Plant Project, besides the strategy to provide reliable power supply for socio-economic growth, the owners of the project also considered the required technical factors and the impact of burning coal to produce electricity on the natural environment. However, despite the differences in the characteristics of the projects, overall, the occurrence of codes of non-financial factors was similar in the three study cases, as shown in Figure 4.4.

Energy infrastructure projects are socio-technical systems with multiple and conflicting requirements. This investigation confirmed the importance of MCDA that include both non-financial and financial factors to reach a satisfactory decision. The RO decision-making theory was applied in the Menengai Power Plant Project. The technical capacities of generation units were changed as the project was under implementation to address unforeseen circumstances in the project environment.

5.3 Decision-making theories in the project appraisals

All three case studies were large energy infrastructure projects, with multiple stakeholders and conflicting demands. The projects affected many sectors in the social lives of the people and economic standing of the affected countries. The theory of MCDA was applied in the appraisals. Since the project environment is dynamic, some decision

made left room for adjustments at a later stage, depending on changes in the project environment. This agrees with the theory of RO. Furthermore, the theory of institutional isomorphism can be seen in the appraisal of Morupule B Power Plant Project. The project did not meet the criteria for reducing emission of greenhouse gases, but there was pressure from the government of Botswana to implement the project as Botswana was desperate for reliable power supply and had set aside US$ 205.83 million for the project. Reports from consultants suggested ways to offset the emissions at a later stage through solar power projects.

5.4 Reconciliation of the research objectives

The aim of this investigation was to explore and investigate non-financial factors considered in the appraisal of energy infrastructure projects in sub-Saharan Africa. The main research question and the subsidiary questions were addressed as follows:

i. *Question 1:* What are the most prevalent non-financial factors that should be considered for the appraisal of energy infrastructure projects in sub-Saharan Africa?
    - The investigation found the following as the most prevalent non-financial factors considered in the appraisal of energy infrastructure projects: Strategic and synergetic, social, environmental, technical, organisational and managerial, political, and legal. Content analysis was used to filter sub-categories of each of these factors in the case studies, and these were listed, codified, and analysed.

ii. *Question 2:* To what extent are non-financial factors applied in the appraisal of energy infrastructure projects in sub-Saharan Africa?
    - Content analysis of the selected case studies showed that non-financial factors are significantly applied in the appraisal of energy infrastructure projects in sub-Saharan Africa. The non-financial factors were determined using both deductive and inductive methods.

iii. *Question 3:* Who are the key players in the appraisal of energy infrastructure projects in sub-Saharan Africa?
    - The key players who influence project appraisals, as identified in the case studies, are financiers, politicians, donors, and consultants. Members of the community, traditional authorities, non-governmental organisations,

implementing agencies, and regulators also influenced project appraisal. These key players were mentioned in the case studies, and they played various roles in project preparation.

5.5 Implications of the findings

For all the three case studies, as shown in Figure 4.4 and Figure 4.5, the highest number of codes appeared in the ‘strategic and synergy’ and ‘social’ categories. This implies that for large infrastructure projects with multiple stakeholders, it is important that the projects be supported by national governments. The projects should be part of the national development plans. Furthermore, synergy should be established between the project and other national economic plans. Energy infrastructure projects are not only capital-intensive, but they also impact multiple stakeholders both in the internal and external project environment.

The key stakeholder in energy infrastructure projects is the community. In sub-Saharan Africa, major social issues are poverty, unemployment, and gender equality. These social codes were found in many places in the project appraisal documents. The implication of these findings is that addressing the social needs of communities increases the chances of a project to being positively appraised.

The categories that had the least number of occurrence of codes were the ‘legal’ and ‘political’ categories. Besides return on investment, financiers are keen on having a stable legal and political environment. The legal system should deliberately aim at reducing or eliminating corruption. Civil disobedience or political revolution impede the efficient operation of infrastructure projects.

The ‘technical’ category is also a code that occurred often. The technical solution should be mature and efficient, and meet the best-established industry standards. There should be sufficient resources and knowledge to operate and maintain the project. The technical solution should minimise the emission of greenhouse gases to protect the environment.

5.6 Proposed framework for project appraisals

Based on the findings of this investigation, the researcher proposed a framework for the appraisal of energy infrastructure projects in sub-Saharan Africa that integrates both non-financial and financial factors. The framework follows an AHP in decision-making,

adapted from Dey (2006:90). In AHP, top level actions represent the overall objective, middle level actions represent the elements affecting decisions, and the lower-level (or starting) actions represent decision options. The framework encourages in-group participation involving stakeholders and considers RO theory. This framework is intended to minimise bias and the agency problem in project appraisal. The framework is presented in Table 5.1 and Figure 5.1.

Table 5.1: Proposed framework for project appraisal (text format)

Step 1 – Project Appraisal Team: The project owner or the authorising authority should specify the necessary attributes for members of the project appraisal team before selecting and vetting them. These members should be subject-matter experts and multi-disciplinary in terms of professional skills. Key stakeholders of the project should also be included in the team, which should be adequately resourced. According to Dey (2006:101), participation by stakeholders helps clear some uncertainties and facilitates the selection of the most appropriate project. To safeguard against conflicts of interest and the agency problem (as described in Section 2.3.6), members of the team should be vetted. Teams should avoid changing or bringing in new members when the process has already started.

Step 2 – Project Appraisal Criteria: Project appraisal criteria should be agreed on up-front and signed off. These may be newly developed or adopted from previous appraisals. The criteria should address both the interests of the project owners and the objectives of the project (Dimitriou, Ward and Dean, 2016:7).

Step 3 – Project Information: Certain information should be obtained for use in appraisals, including the project description, project proposal, project feasibility reports, project agreements, and financial and economic parameters of the project environment. The team should evaluate the adequacy of all information before proceeding to the next step. If the information is not adequate, the project owner or authorising authority should be informed, and guidance sought on whether to proceed.

Step 4 – Non-financial Evaluation: Non-financial evaluations should be carried out before financial evaluations. The following categories of non-financial factors should be evaluated: Strategic and synergy, technical, legal or regulatory, organisational and managerial, social, environmental, and political. The appraisal team may include additional categories of non-financial factors and should discuss and assign weightings to the non-financial factors. According to Dey (2006:92), a project selection model should allow for both subjectivity (arising from experience and knowledge) and objectivity and should take advantage of "using in-group decision-making framework with the involvement of the concerned stakeholders". The team should then evaluate the project based on the stated categories of non-financial factors. The team should assign scores for the evaluation based on the agreed weights.

Step 5 – Financial Evaluation: The project appraisal team should carry out a financial and economic evaluation for the project. Dey (2006:90) also put financial evaluation after strategic and technical evaluation in his model for project evaluation and selection.

Step 6 – Aggregate Evaluation Scores: The team should determine the aggregate non-financial and financial scores of the evaluation based on the agreed criteria.

Step 7 – More Options: The appraisal team should consider other options for the project in order to reach an optimum appraisal decision. This entails considering variations, cases, scenarios and sensitivities of variables. Stakeholders may also avail more information on project options. Once every real option is set, the evaluation process should re-start from Step 4 (non-financial evaluation) and repeat until an optimum appraisal decision is reached. Venetsanos, Angelopoulou and Tsoutsos (2002:299) and Ofori et al. (2021:2) applied RO to optimise the selection and add value to the project investor.

Step 8 – Appraisal Decision: The project appraisal team should make only one of the following four decisions: 1) re-work (send back to project preparation); 2) abandon project; 3) keep project on hold (differ implementation to a specified date); and 4) implement project.

Step 9 – Reporting: The appraisal team should prepare a report on the entire project appraisal process, complete with the recommended appraisal decision and associated remarks. In the report, approval should be sought from the project owner or project authorising authority to implement the recommended appraisal decision.

Figure 5.1 below presents the same framework for project appraisal in chart format.

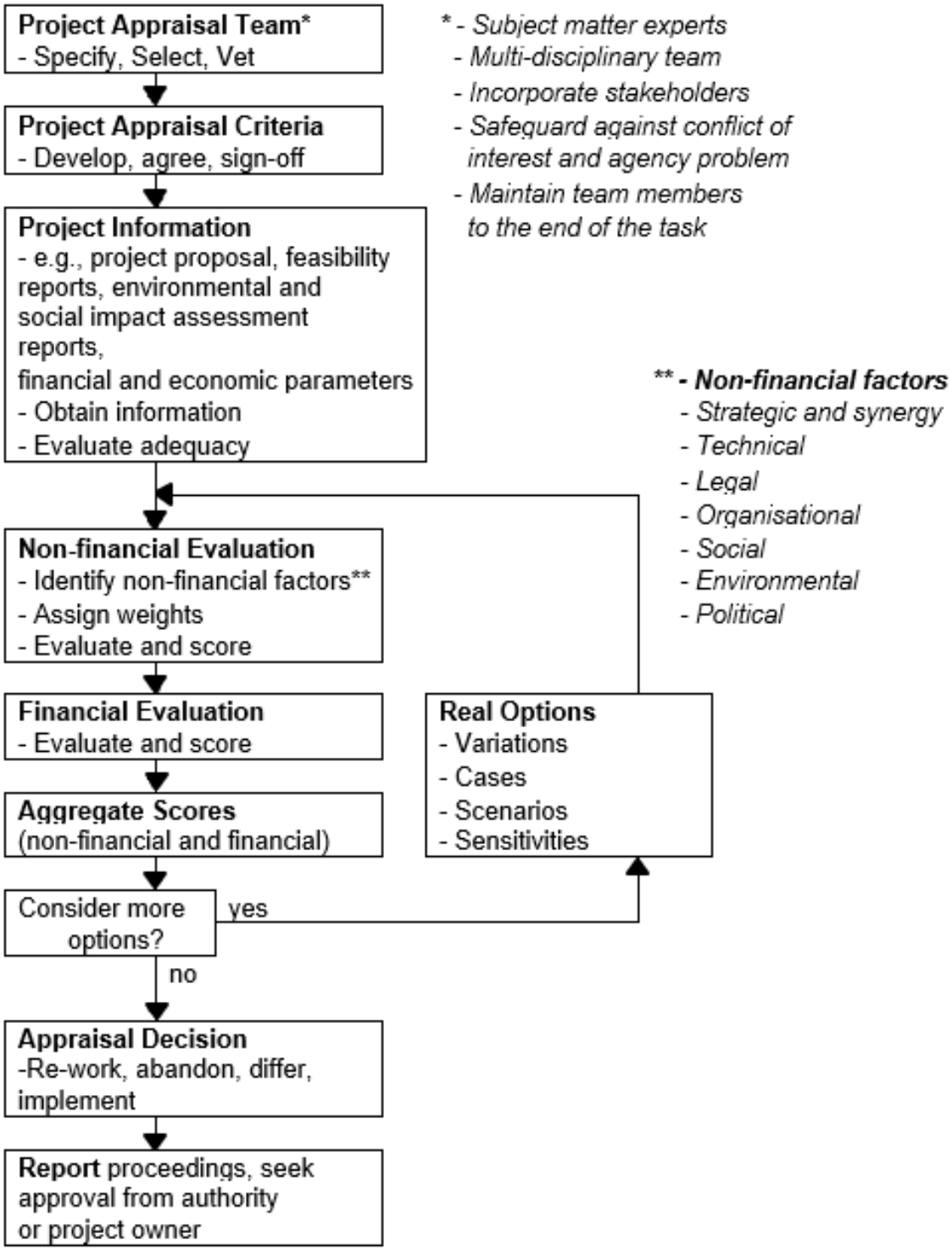

Figure 5.1: Proposed framework for project appraisals (chart format)

CHAPTER 6
CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

The aim of this research was to explore and investigate the non-financial factors that should be considered in the appraisal of energy infrastructure projects in sub-Saharan Africa. The study was guided by the following main research question:

- What are the most prevalent non-financial factors that should be considered for the appraisal of energy infrastructure projects in sub-Saharan Africa?

Secondary research data comprising project appraisal documents were obtained from official online databases of the World Bank and AFDB. A qualitative research design using multiple case studies was applied. The main data analysis method used was content analysis, aided by the *QDA Minor Lite* software tool. Codes of non-financial factors were determined from three case studies.

The findings showed that the most prevalent non-financial factors that should be considered in the appraisal of energy infrastructure projects in sub-Saharan Africa fall under the following seven categories:

- *S*trategic and synergy;
- Social;
- Environmental;
- Technical;
- Organisational and managerial;
- Political; and
- Legal.

The findings also showed that non-financial factors are applied to a very large extent in the appraisal of energy infrastructure projects in sub-Saharan Africa.

The case studies were large projects with national interest. It was found that non-financial factors that fell under the strategic and synergy category, social category, and technical category surpassed non-financial factors in other categories. This finding showed that energy infrastructure projects are socio-technical systems. Both social and technical non-financial factors featured strongly in the appraisal of the projects. Non-financial factors

under the political and legal categories scored the least in the content analysis, but they still had a significant impact on the appraisal of the projects.

In this research, the following were found as key players in the appraisal of energy infrastructure projects in sub-Saharan Africa: Financiers (including DFIs), project developers, project owners (including governments), consultants, energy regulators, civil society or non-governmental organisations, implementing agencies (including electric power utilities), politicians, and local communities. They have varying levels of impact on the project appraisal activity.

This research showed that non-financial factors are very important in the appraisal of energy infrastructure projects in sub-Saharan Africa. In conclusion, to ensure the projects successfully pass from preparation to implementation at appraisal stage, non-financial factors should be given adequate consideration by project practitioners in the project preparation phase.

6.2 Recommendations

Based on findings of this investigation, the researcher made the following recommendations:

i. Project practitioners should address the non-financial factors of project viability during project preparation to ensure the project successfully pass the appraisal stage.
ii. Project developers or project owners should allocate adequate resources to project preparation to cover the assessment of non-financial factors, before taking the project to the appraisal stage.
iii. The project appraisal team should be multi-disciplinary in terms of professional skills, and necessary safeguards should be put in place to prevent the agency problem and conflicts of interest.
iv. Project appraisers should be trained to assess the non-financial factors of project appraisal as non-financial factors are more complex than financial factors.
v. Since an energy infrastructure project is a social-technical system that affect many sectors and thrives in a dynamic environment, the MCDA and RO theories of decision-making should be applied in the project appraisal process.

6.3 Research contribution to theory and practice

It was noted in the literature review that guidance on the application of non-financial factors in the project appraisal process is scarce (Lopes and Flavell, 1998:232). It was also noted that there is a general lack of understanding of the effect of non-financial factors on project appraisals (Masini and Menichetti, 2013:515). Batra and Verma (2018:100) called for more deliberation on non-financial factors during project appraisals. Therefore, this exploratory research highlighted the importance of non-financial factors in the appraisal of energy infrastructure projects in sub-Saharan Africa. This outcome may help project practitioners address non-financial factors during project preparation, which may lead to more projects passing the appraisal stage from preparation to implementation. In addition, the outcome of this research may help project appraisers conduct the holistic and integrated project appraisals necessary for the successful implementation of a project. This outcome may contribute towards national and regional efforts to accelerate the implementation of the much-needed energy infrastructure projects in sub-Saharan Africa.

The proposed framework for project appraisal that is one of the outcomes of this research (see Section 5.6) may guide the application of non-financial factors in the appraisal of energy infrastructure projects in sub-Saharan Africa.

6.4 Limitations, recommendations and actions for future research

6.4.1 Limitations

This investigation was subject to the following limitations:

i. Previous research data: Data of similar investigations carried out previously were very scarce.
ii. Time and scope: The investigation had to be completed in the period prescribed by the university. Thus, the scope was limited to what could be achieved within the available time. There was also a limit to the number of words for this dissertation, and therefore, some sections, tables and charts for the findings had to be left out.
iii. Software capabilities: The *QDA Minor Lite* software was capable of content analysis and not thematic analysis. Thus, the research was limited to content

analysis. Furthermore, the statistics in the content analysis were generated by the software. A few charts were composed in Microsoft Excel software.

iv. Research data: Research data was limited to project appraisal reports. These reports were composed and signed off by the World bank and the AFDB. Other documentation, such as minutes of project appraisal meetings, were not found.

v. Case studies: The case studies were chosen only from large energy infrastructure projects in sub-Saharan Africa in the electric power supply category. These were projects with national interests. The case studies excluded energy projects for the supply and transportation of petroleum and natural gas products, such as pipeline projects.

vi. Positive appraisal: The case studies were energy infrastructure projects that had positively passed project appraisal. No project that failed the appraisal process was studied.

The research design and methodology were followed rigorously. These limitations had no negative impact on the investigation.

6.4.2 Recommendations for future research

The researcher made the following recommendations for future research:

i. Future studies should not be limited to large energy infrastructure projects. But, they should also investigate the role of non-financial factors in the appraisal of small-scale projects, e.g. at industrial level.

ii. Categories of non-financial factors on the appraisal of energy infrastructure projects, such as political factors, should be studied separately and in detail.

iii. During the content analysis of document data, categories of non-financial factors and their respective codes should be given weights, depending on the level of impact on project appraisal. During content analysis, the count of some codes may be smaller than others, but they may have a bigger impact on the appraisal decision.

6.4.3 Actions to implement the recommendations

The following actions are proposed to implement the recommendations of this investigation:

i. The investigation should be presented at a forum of industry and academic captains and students. Comments should be obtained on the implementation of the recommendations.

ii. Researchers should be encouraged to embark on the recommended further studies.

iii. Industry captains should be encouraged to support the research through funding or the provision of research data.

iv. A framework for the application of non-financial factors in the appraisal of energy infrastructure projects, complete with a flow chart of activities, was proposed as part of the outcome of this investigation. In sub-Saharan Africa, several projects are under appraisal in both the private and public sectors, and these project practitioners should be encouraged to test and apply this new framework.

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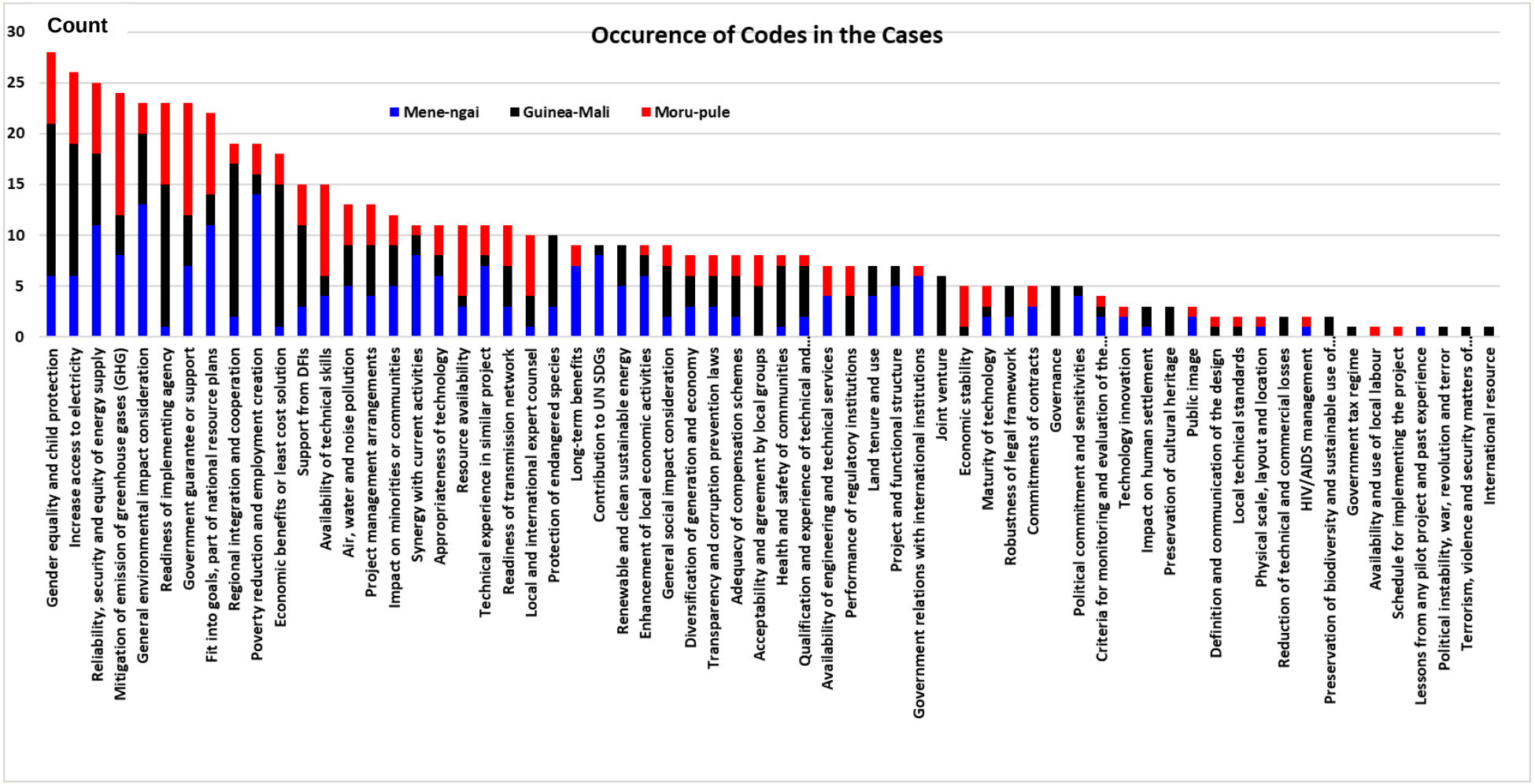
APPENDIX A: OCCURRENCE OF CATEGORIES IN ALL THE THREE CASE STUDIES

No.	Coding category	Code	Mene-ngai	Guinea-Mali	Moru-pule	All
1	Social	Gender equality and child protection	6	15	7	28
2	Strategic and synergy	Increase access to electricity	6	13	7	26
3	Strategic and synergy	Reliability, security and equity of energy supply	11	7	7	25
4	Environmental	Mitigation of emission of greenhouse gases	8	4	12	24
5	Environmental	General environmental impact consideration	13	7	3	23
6	Organisational and managerial	Readiness of implementing agency	1	14	8	23
7	Political	Government guarantee or support	7	5	11	23
8	Strategic and synergy	Fit into goals, part of national resource plans	11	3	8	22
9	Strategic and synergy	Regional integration and cooperation	2	15	2	19
10	Social	Poverty reduction and employment creation	14	2	3	19
11	Strategic and synergy	Economic benefits or least cost solution	1	14	3	18
12	Strategic and synergy	Support from DFIs	3	8	4	15
13	Technical	Availability of technical skills	4	2	9	15
14	Environmental	Air, water and noise pollution	5	4	4	13
15	Organisational and managerial	Project management arrangements	4	5	4	13
16	Social	Impact on minorities or communities	5	4	3	12
17	Strategic and synergy	Synergy with current activities	8	2	1	11
18	Technical	Appropriateness of technology	6	2	3	11
19	Technical	Resource availability	3	1	7	11
20	Technical	Technical experience in similar project	7	1	3	11
21	Technical	Readiness of transmission network	3	4	4	11
22	Technical	Local and international expert counsel	1	3	6	10
23	Environmental	Protection of endangered species	3	7		10

No.	Coding category	Code	Mene-ngai	Guinea-Mali	Moru-pule	All
24	Strategic and synergy	Long-term benefits	7		2	9
25	Strategic and synergy	Contribution to UN SDGs	8	1	0	9
26	Technical	Renewable and clean sustainable energy	5	4	0	9
27	Social	Enhancement of local economic activities	6	2	1	9
28	Social	General social impact consideration	2	5	2	9
29	Strategic and synergy	Diversification of generation and economy	3	3	2	8
30	Legal	Transparency and corruption prevention laws	3	3	2	8
31	Social	Adequacy of compensation schemes	2	4	2	8
32	Social	Acceptability and agreement by local groups	0	5	3	8
33	Environmental	Health and safety of communities	1	6	1	8
34	Organisational and managerial	Qualification and experience of technical and managerial teams	2	5	1	8
35	Technical	Availability of engineering and technical services	4	0	3	7
36	Legal	Performance of regulatory institutions	0	4	3	7
37	Social	Land tenure and use	4	3	0	7
38	Organisational and managerial	Project and functional structure	5	2	0	7
39	Political	Government relations with international institutions	6	0	1	7
40	Strategic and synergy	Joint venture	0	6		6
41	Strategic and synergy	Economic stability	0	1	4	5
42	Technical	Maturity of technology	2	1	2	5
43	Legal	Robustness of legal framework	2	3		5
44	Legal	Commitments of contracts	3	0	2	5
45	Organisational and managerial	Governance	0	5	0	5
46	Political	Political commitment and sensitivities	4	1		5

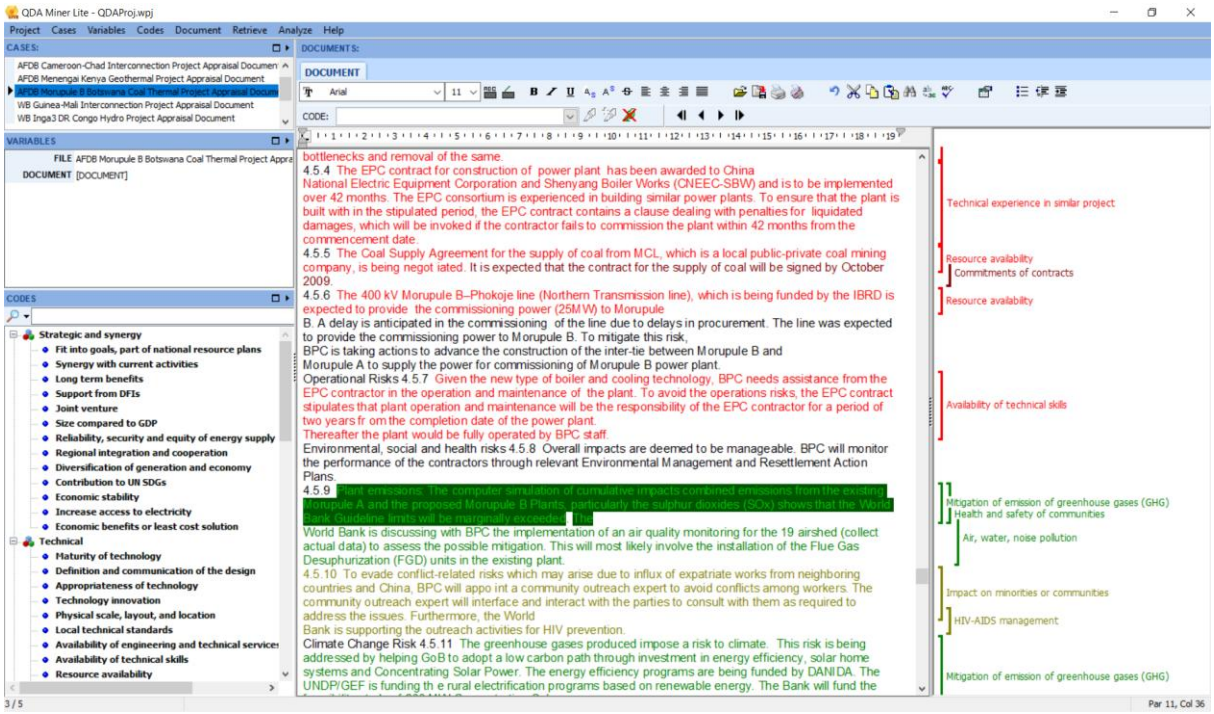
No.	Coding category	Code	Mene-ngai	Guinea-Mali	Moru-pule	All
47	Organisational and managerial	Criteria for monitoring and evaluation of the performance of the project	2	1	1	4
48	Technical	Technology innovation	2	0	1	3
49	Social	Impact on human settlement	1	2	0	3
50	Social	Preservation of cultural heritage	0	3	0	3
51	Political	Public image	2		1	3
52	Technical	Definition and communication of the design	0	1	1	2
53	Technical	Local technical standards	0	1	1	2
54	Technical	Physical scale, layout and location	1	0	1	2
55	Technical	Reduction of technical and commercial losses	0	2	0	2
56	Social	HIV/AIDS management	1		1	2
57	Environmental	Preservation of biodiversity and sustainable use of natural resources	0	2	0	2
58	Legal	Government tax regime	0	1	0	1
59	Social	Availability and use of local labour	0	0	1	1
60	Organisational and managerial	Schedule for implementing the project	0	0	1	1
61	Organisational and managerial	Lessons from any pilot project and past experience	1	0	0	1
62	Political	Political instability, war, revolution and terror	0	1	0	1
63	Political	Terrorism, violence and security matters of stakeholders	0	1	0	1
64	Political	International resource	0	1	0	1
		Total	211	222	159	592

APPENDIX B: *QDA MINOR LITE* CHART OF CODES IN THE THREE CASE STUDIES



APPENDIX C: *QDA MINOR LITE* WORD CLOUD OF NON-FINANCIAL FACTORS FROM ALL THE THREE CASE STUDIES

APPENDIX D: SNAPSHOT OF CONTENT ANALYSIS IN *QDA MINOR LITE*



APPENDIX E: ETHICS CLEARANCE CERTIFICATE

Application for Approval of Ethics in Research (EiR) Projects
Faculty of Engineering and the Built Environment, University of Cape Town

ETHICS APPLICATION FORM

Please Note:
Any person planning to undertake research in the Faculty of Engineering and the Built Environment (EBE) at the University of Cape Town is required to complete this form **before** collecting or analysing data. The objective of submitting this application *prior* to embarking on research is to ensure that the highest ethical standards in research, conducted under the auspices of the EBE Faculty, are met. Please ensure that you have read, and understood the **EBE Ethics in Research Handbook** (available from the UCT EBE, Research Ethics website) prior to completing this application form: http://www.ebe.uct.ac.za/ebe/research/ethics1

APPLICANT'S DETAILS		
Name of principal researcher, student or external applicant		Sydney Kadikula Zimba
Department		Construction Economics and Management
Preferred email address of applicant:		sydneykadikulazimba@yahoo.com
If Student	Your Degree: e.g., MSc, PhD, etc.	MSc in Project Management
	Credit Value of Research: e.g., 60/120/180/360 etc.	60
	Name of Supervisor (if supervised):	Dr. Krystle Ontong
If this is a researchcontract, indicate the source of funding/sponsorship		No
Project Title		

An investigation of nonfinancial factors for appraisal of energy infrastructure projects in Sub-Saharan Africa.

I hereby undertake to carry out my research in such a way that:

- there is no apparent legal objection to the nature or the method of research; and
- the research will not compromise staff or students or the other responsibilities of the University;
- the stated objective will be achieved, and the findings will have a high degree of validity;
- limitations and alternative interpretations will be considered;
- the findings could be subject to peer review and publicly available; and
- I will comply with the conventions of copyright and avoid any practice that would constitute plagiarism.

APPLICATION BY	Full name	Signature	Date
Principal Researcher/ Student/External applicant	Sydney Kadikula Zimba		23 May 2021
SUPPORTED BY	Full name	Signature	Date
Supervisor (where applicable)	Dr. Krystle Ontong		24 May 2021

APPROVED BY	Full name	Signature	Date
HOD (or delegated nominee) Final authority for all applicants who have answered NO to all questions in Section 1; and for all Undergraduate research (Including Honours).	**Dr. Frank K. Ametefe**		**11/06/2021**
Chair: Faculty EIR Committee For applicants other than undergraduate students who have answered YES to any of the questions in Section 1.	**Dr. Frank K. Ametefe**		**11/06/2021**

APPENDIX F: LETTER FROM LANGUAGE EDITOR

KARIEN HURTER
Copy Editor and Proofreader
Email: karien.hurter@gmail.com
Tel: 071 104 9484

27 June 2024

To Whom It May Concern:

This letter is to confirm that *An Investigation of Non-Financial Factors for the Appraisal of Energy Infrastructure Projects in Sub-Saharan Africa* by Sydney Zimba was edited by a professional language practitioner. It requires further work by the author in response to my suggested edits. I cannot be held responsible for what the author does from this point onward.

Regards,

Karien Hurter

KARIEN HURTER
Copy Editor and Proofreader
Email: karien.hurter@gmail.com
Tel: 071 104 9484

28 October 2024

To Whom It May Concern:

This letter is to confirm that *An Investigation of Non-Financial Factors for the Appraisal of Energy Infrastructure Projects in Sub-Saharan Africa* by Sydney Zimba was edited by a professional language practitioner. It requires further work by the author in response to my suggested edits. I cannot be held responsible for what the author does from this point onward.

Regards,

Karien Hurter