AN INVESTIGATION OF PROJECT SELECTION IN THE RENEWABLE ENERGY SECTOR OF ZAMBIA

by

Percy J. Saili

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DECLARATION

I hereby declare that the work presented in this dissertation is the result of my research work and that it has not previously been submitted for a degree, diploma or other qualification at this or another University.

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Signature Date

APPROVAL

This dissertation of Percy Saili is approved as fulfilling in the partial requirements for the award of the Degree of Master of Engineering in Project Management by the University of Zambia.

Examiner 1: ……………………Signature………………… Date: ……………………………

Examiner 2: …………………Signature…………………… Date: ……………………………

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Chairman Board: ……………Signature…………………… Date: …………………………
of Examiners

Supervisor: …………………Signature…………………… Date: ……………………………

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ABSTRACT

Project selection and the development of its portfolio in line with corporate strategy is an important task of decision makers in the renewable energy sector of both public and private sector organizations. The selected projects have to meet appropriate time frame for completion and delivery, a suitable risk profile and other distinct factors in order to achieve corporate objectives.

A modified Delphi approach has been applied in this study to investigate the best practice of project selection in the renewable energy sector of Zambia and to determine the factors that contribute to the optimal selection of projects and the associated strategic level decision making.

The findings of this study indicate that no single best practice exists in this sector even though there are similarities in the criteria used. Each of the participants in the study consented to a particular criterion depending on the factors that are appropriate to their organizations' regulatory environment, stakeholders, experiences and personnel capabilities.

The study further revealed that of the factors that contribute to selection of projects, the most renowned are: energy/technical risk, personnel resources/capabilities, social, political, and environmental issues, knowledge of the work, governance, strategic alignment/leverage and time. All these factors were found to be significant to both public and private sector organisations and very influential on strategic decision making.

The findings of this study are crucial to the applications of best practice of project selection and value of investment. Organisations that fail to give consideration of these factors when making their choice on projects will not fully realise the value on their investment. With these identified factors, organisations can develop project selection models that permit them to optimize time and money, minimize losses while maximizing the likelihood of success of projects.

Keywords: Project selection, renewable energy, strategic decision making, Zambia

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LIST OF ABBREVIATIONS AND ACRONYMS

AfDB African Development Bank

AHP Analytical Hierarchy Process

ARR Accounting Rate of Return

ARR Accounting/Average Rate of Return

CACF Constant Annual Cash Flow

CDM Clean Development Mechanism

ESMAP Energy Sector Management Assistance Program

EV Expected Value

GDP Gross Domestic Product

IRR Internal Rate of Return

MoU Memorandum of Understanding

MW Megawatts

NEP National Energy Policy

NPV Net Present Value

PBP Pay Back Period

PMI Project Management Institute

RAI Return on Average Investment

REN Renewable Energy-Policy Network

REP Regional Energy Protocol

ROCE Return On Capital Employed

ROI Return On Investment

SADC Southern Africa Development Community

SAPP Southern African Power Pool

SNDP Sixth National Development Plan

SREP Scaling-Up Renewable Energy Programmes

UNIDO United Nations Industrial Development Organization

WB World Bank

CHAPTER 1: INTRODUCTION

1.1 Introduction

All organizations, public, private or those of the charitable nature undertake projects in line with set strategic goals and beliefs. The choice of project selection differs from organization to organization and so do the reasons that organisations undertake those projects. For instance, one organization may undertake a project to support its operations, meet strategic objectives or respond to a need. Another may undertake a project to solve a problem, develop an idea or realize investment opportunities (Meredith & Mantel Jr, 2009). Usually projects are selected from among numerous opportunities. The decision of determining which projects should be undertaken is no simple one because the consequences of poor decisions can be enormously expensive both in monetary and time costs (Pinto J. 2016).

Investment managers of firms or organisations often find themselves at the crossroads of making decisions on the type of investment to pursue for their firms or organisations using the given resources. The choice of selecting which opportunity to pursue is never a straight forward one because strategic goals and objectives of organisations and institutions are the drivers of project selection. Managers have to select viable projects and develop guidelines for balancing the opportunities and costs associated with each alternative. They must strive to maintain a balance between the competing demands of time and opportunity (Meredith & Mantel Jr, 2009).

Managers also consider time and money costs in decision making. Decision makers understand that successful projects are those made in a timely and cost efficient manner, the English adage 'time wasted is opportunity lost' thus becomes so real to those decisions makers. On the other hand, these decision makers must exercise caution in that they want to be sure that they are making the best choice among their options (PMI 2008). Organisations develop selection models that permit them to optimize time and money, minimize losses while maximizing the likelihood of success.

1.2 Research problem and Justification

The industrial revolution of the 18th century brought about an endless need for energy for both productive and domestic uses, thereby changing the way man interacts with the natural environment. In 1994 the government of the republic of Zambia adopted its first national energy policy (NEP 1994) whose aim was to promote the optimal supply and utilisation of energy, especially indigenous energy forms, for socio-economic development in a safe and health environment. Over the years this policy has had to undergo changes to harness the potential in the sector to drive the economic growth and reduce poverty in the country. Among the objectives of this policy is to promote the utilization of renewable energy and ensure efficiency is attained in the manner of producing it (NEP 2008).

Despite this move by government, the development of renewable energy remains significantly low (SREP 2018). This observation is significant. There is need to understand the reason for this phenomenon if the objectives set forth in the energy policy and the national development plans will be attained. From project management perspective, the selection of projects in line with strategic objectives for individual organization has significant impact for project success (Meredith & Mantel Jr, 2009). Hence the aim of this research is to determine the main factors that are currently being considered by decision makers in the renewable energy sector as they undertake the selection of various energy related projects.

The significance of the findings in this research is that these factors are crucial for organisation to make the best choice of projects, for the value of investment made. With these identified factors, organisations can develop selection models that permit them to optimize time and money, minimize losses while maximizing the likelihood of success. This will assist companies to thrive and remain competitive among their competitors. Losses and lost opportunities are reduced through proper project selection.

1.3 Research Questions

(i) What is current practice in the selection of renewable energy projects in the energy sector of Zambia?

(ii) What factors are considered as crucial when it comes to selecting projects the Renewable Energy sector and why are these factors significant?

(iii) Are these factors universal across this sector?

1.4 Research Aim and Objectives

The aim of this research is to investigate factors that influence project portfolio selection in the renewable energy sector of Zambia.

Objectives

(i) identify factors that influence project selection

(ii) examine the identified factors and determine why these factors are significant

(iii) determine the universality of these factors across the sector in Zambia

1.5 Benefits of the Research

In line with the fact that the use of energy has brought about significant changes in man's interaction with the environment and is critical to project selection, this research is vital in providing insight on investment project portfolio in Zambia. As a result of this research, a model which can be adopted for selecting project on investment portfolios for firms in Zambia can be developed. The model has the potential to reduce technology and commercial risk, and rapidly screen and rank options and trade-offs, thereby accelerating deployment of investment projects. The model helps in project selections, ensuring that selected projects benefit the organization. It also contributes to effective project management by enhancing operational efficiencies of managers to achieve the best possible results using available resources. The study gives organisations using it a competitive edge over other organisations that have no model of selection in place.

1.6 Methodology

The methodology provided insight into the methods used to collect data for this research. Structured interviews were used to obtain data from participants in decision making in organisations who operate in the renewable energy sector of Zambia. A questionnaire was generated with the questions derived systematically by analyzing the different aspects of investment project portfolio selection relating to the research questions and propositions. Interviews were also used as a data collection tool. A list of open-ended questions was used to guide the interviews and ensure that all aspects of the research questions were covered during the discussions. Secondary tools included information published on company websites and in other company documents. Content analysis was used to analyze the data. The three quality-control principles, recommended by Yin (Yin, 2014) namely (1) the use of multiple sources of evidence, (2) the creation of a survey database, and (3) maintaining a chain of evidence, were used to improve the accuracy, reliability and validity of collected data throughout the research.

1.7 Dissertation structure

Chapter 1 introduces the background to this research project. It also outlines the problem statement on the objectives set and the extent to which the techniques and decision making in project selection is applied.

Chapter 2 discusses the literature review on topics of project selection criteria, tools and techniques, project prioritization and balancing, decision making and some of the parallels with human factors in the field behavioral economics.

In Chapter 3, the research method is described. The research framework and how it is designed to achieve the research objectives which are presented are contained here. Later in this chapter, there is a description of the research models considered for this research project, followed by details of the selected model.

Chapter 4 presents the results obtained.

Chapter 5 provides a detailed discussion on the findings of the research and examines them against an extended literature review, as described earlier.

Chapter 6 presents the conclusions and implications from this research project. They are compared against the research questions. The limitations of the research are described along with suggestions on how this research can be extended.

1.8 Chapter Summary

This chapter presented a background to the research providing the justification for undertaking it, establishing the aim and objectives of the study. This chapter further went on to outline the structure of the report. Also discussed in this chapter is the organization of the dissertation. The next chapter discusses literature reviewed.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

The previous chapter laid out the background and framework for the study. This chapter reviews literature on project selection models; tools and techniques; project prioritization and balancing; project portfolio selection models; and the critical factors to consider when choosing models for project and portfolio selection, with a specific focus on renewable energy sector in Zambia. Literature review on project selection models, decision making, and portfolio management, as applied to investment projects in Zambia was done in order to identify the gaps and form basis for comparison with the current practice in Zambia.

The renewable energy sector in Zambia is one of the areas identified by Government under the Seventh National Development Plan (7NDP 2017) as key for Zambia's economic growth and development. By giving attention to this sector, the government hopes to be able to meet some of the goals set out in the millennium development goals, specifically eradication of extreme poverty and hunger, combating HIV/AIDS Malaria and over diseases, promoting gender equality and the empowerment of women. The government has taken bold steps to make this a reality and have put in place the national energy policy whose clear mandate is create conditions that will ensure the availability of adequate supply of energy from various sources, which are dependable, at the lowest economic, financial, social and environmental cost consistent with national development goals. This policy is in cognizance of the fact that for renewable to make significant impact on the lives of people, the private sector participation to supplement government effort in increasing access rates to energy cannot be overlooked. There is need to attract more investment for improved energy infrastructure development and management of the resource in order to enhance economic growth and make the resource available to all (NEP, 2008). There is therefore immense opportunities for private investment participation here. In order to appreciate the potential and spread of renewable energy use in Zambia, we have to briefly look at the sector.

2.1 The renewable energy sector

With the national electrification rate standing at 45% for urban area and 3% for rural area, a specific focus has been placed on enhancing national access to electricity to 90% and 51% access by 2030 in urban and rural areas, respectively (Ndhlukula, et al, 2015). The huge goal of providing access to energy for development to the productive population is top priority not only for Zambia but for the SADC region. With an estimated population of 280 million and a combined GDP of

USD 575.5 billion as reported in 2010, the SADC region is growing at 5.14% (SADC STATISTICS 2018). In 2008, the SADC primary energy supply was estimated around 9,552 pet joules (PJ) (International Energy, 2011). Coal dominated the primary energy mix with a large share of 44%, followed by renewable energy (39%), oil (14%), gas (2%), and nuclear (1%). The 39% share for renewable energy is distributed among traditional biomass (36.66%), primarily used for cooking and heating, hydro (1.95%), and modern biomass (0.39%). Other renewable energy sources such as solar, geothermal, wind and biofuels (Dastgeer, Karhammar, Mwenechanya, Kanduli, & Muleya, 2011). The SADC has drawn up many energy access goals. Access to adequate and reliable energy services for the entire SADC region is key in achieving a regional growth and reducing poverty on a sustainable basis. The Region has established an operational goal to reduce the number of SADC inhabitants who do not have access to energy services by 50% by 2020, and reduce the number of those remaining without access by 50% every five years until the strategic goal of full access was achieved. Efforts to increase access to energy focus on the expansion of distribution networks, often implemented by the national utilities, and the use of small-scale distributed generation, often implemented through Rural Electrification Agencies. Furthermore, the SADC put in place a Regional Renewable Energy and Energy Efficiency Agency. In response to the requirement identified by the SADC member countries' ministries of energy and other regional stakeholders during a consultation process. The preliminary goal was to create an enabling environment for the uptake of renewable energy and energy efficiency through energy planning and policies, business models and technical innovation (Ndhlukula, et al, 2015).

SADC member countries have signed several inter-governmental memorandum of understanding (MoUs) like the Southern African Power Pool (SAPP) established 1995 and the Regional Energy Protocol (REPP) of 1996. These agreements ensure consumers in each member country optimize the use of available energy resources in the region, and support inter-country co-operation during emergencies and recognize the need for a coordinated approach to energy strategy formulation and planning for the SADC. As of June 2018, the installed capacity of the total energy shared among SAPP members was estimated at 67,190 Megawatts (MW) with an available capacity of 60,719 MW, against a peak demand plus excess of 55,009 MW (SAPP, 2018) with most of the energy coming from coal (74% of the total), followed by hydro (20%) with nuclear and diesel covering 4% and 2% respectively. To meet rising demand and support economic growth, the African Development Bank Report of 2010 estimated that about 7,000 megawatts (MW) of new generation capacity must be installed each year (African Development Bank , 2010). The report estimates the cost of such investment at USD 41 billion per year, which represents 6.4% of the region's GDP. This cost is in exclusion of the cost for clean energy.

The outstanding boom in sustainable energy investment throughout the last decade in many parts of the world has been triggered by favorable shifts in risk-return. Experts estimate that unless stronger commitments and effective coverage measures are taken to reverse current trends, half the population in sub-Saharan Africa will still be without energy by 2030, and the percentage of the population relying on traditional fuels for household energy needs will remain the highest among all world regions (UNIDO, 2011). Despite the region enjoying a great share of natural sources, access to affordable energy remains a challenge: most countries in the region have renewable energy potential many times the current demand (The World Bank, 2010) and the potential is exploitable using currently proven technologies and available knowledge in electricity generation from hydropower, geothermal, wind, biomass and solar energy sources. To date, the capacity and advantages of renewable strength have not been seized in the sub-Saharan African regardless of the numerous economic, social, and environmental advantages associated with it.

Renewable energy has an advantage over other forms of energy in that it can easily be packaged and distributed. This makes it specifically suitable for remote and rural areas that can only be reached cost-effectively with off-grid technologies (African Development Bank , 2010). Most importantly, renewable energy can put an end to many countries' reliance on the expensive and risky imports of fossil fuels such as oil and coal and can be an avenue for Africa to better exploit the economic opportunities offered by international carbon markets. The region also has huge *geothermal* potential, thanks to the Great Rift Valley located in eastern Africa. An estimated 9,000 MW of energy can be generated from geothermal strength in this region, yet the installed capacity is by far not even closer to a quarter of that potential.
Wind energy is another potential source of energy for the region. Great wind speeds enough to generate energy can be attained around coastal regions and the eastern highlands. Madagascar,

Mauritania, Cape Verde, Kenya, Sudan, and Chad have great potential. As with geothermal energy, Sub-Saharan Africa has not taken advantage of this energy source.

Sub-Saharan Africa has yet another source for potential electricity generation from *biomass*. Dasappa (2011) estimates that by using 30 % of the residues from agriculture and the wood processing industry in sub-Saharan Africa, 15,000 MW could be could be realized. So far, the role that renewable technologies have played in all other countries of the region has been minimal. However, recent data from the current pipeline of Clean Development Mechanism (CDM) projects appears to suggest that increased renewable energy interest has more recently started to materialize in the region. Great potential for the development of generating capacity from renewable energy in the region exist. The key lies in deployment of innovative technology in the generation and distribution of this energy.

Renewable energy technologies are deployable in a decentralized and modular manner. This makes them a particularly suitable energy source for small grids or off-grid solutions, which in turn bear great potential in many rural regions where connection to the grid is too expensive. Extending current grid electricity to 66 per cent of Africans living in rural areas would, in many instances, would require large and costly infrastructure (African Development Bank , 2010). Even if this could be encouraged, off-grid renewable solutions would remain cheaper and more sustainable options for rural areas in the SADC Region according to REN21, a renewable energy policy network (REN21, 2018). Furthermore, renewable energy generation can increase energy security, by diversifying the existing energy portfolio and reducing dependence on imports of fossil-fuels. The countries of SADC may, in aggregate terms, export five times the volume of oil (crude and refined products combined) than they import. Currently, the total petroleum product imports significantly surpass total exports, and trends show the trends to be on the rise. The United Nations environmental report on Drivers and barriers for private finance in SADC commented on this when they said, "the exports of petroleum based products grew by 61 per cent from 223 thousand barrels per day in 1998 to 360 thousand barrels per day in 2008, imports grew by 72 per cent from a much higher level at 528 thousand barrels per day in 1998 to 908 thousand barrels per day in 2008". (UNEP,2012). This shows that there is generally a high dependency on depletable energy sources and Zambia as a country is also included in these increasing statistics of dependence. In terms of readiness for renewable energy as a country the government with the help of various stakeholders such as the world bank, has undertaken several steps such as gathering preliminary data on site location for solar, wind bioenergy and geothermal energy. Energy Sector Management Assistance Program (ESMAP), is undertaking renewable energy resource measurement campaign to provide Zambian policy makers, stakeholders, and independent power producers with accurate and valuable data of the national wind, solar, bioenergy geothermal and other resource, including complementary tools, which can be of direct practical use, both for formulating energy policy and implementing wind projects. These efforts are being made in various locations primarily for the purpose of validating the national renewable energy resource maps. Several locations are promising to be could be considered viable and potentially bankable with abundance of the renewable energy source (SREP, 2018).

2.2 Project selection

Prior to embarking on the specifics of any particular project, experts recommend that fundamental market characteristics that create the conditions for success and provide sufficient support for the project be gauged. A lack of well-packaged, bankable renewable energy projects can contribute hindrance of infrastructure development in Zambia (ICA, 2014). For a project to be considered worth of pursuing, it must have a clear pathway to success and enough opportunity that it simply cannot be ignored. It is driven by some baseline need or interest in completing the project, the fundamental economics of energy in the area, existing policy environment (both internal and external to the project sponsor), and available commercial technologies and renewable resource. With project motivation clearly established and communicated, decision makers can seriously approach a specific project with purpose and confidence that the first incremental investment in the project (in time, financial or political capital, etc.) is worthwhile (Springer, 2013).

Springer outlines the following five critical areas that must be looked at in selecting projects in the renewable energy sector: **Baseline**- a clear concise reason why the projects is desired must be stated; **Economics**- a reasonable objective analysis of the fundamental energy economics that compares the acquisition of energy from existing sources to the proposed source must be done; **Policy**- meticulous effort to understand the policies relating to renewable energy and the barriers they present must be done to avoid suffering the risk of not following laid down polices; **Technology**- an assessment to understanding the availability of resources and commercial conversion technologies to avoid nonbankable or unrealistic early-stage technologies must be done; **Consensus**- there must be a buy-in, a common understanding of the project fundamentals, and a unification of purpose.

With this back ground in mind and looking at the case of the failed miniature geothermal power plant at Kapisya hot springs, one of these considerations mentioned above may have been missing.

This project has become now a white elephant project with millions of dollars in capital stuck up. Its is such projects which have led to investigate what factors are to be considered when selecting projects that will have sure success. In order to achieve an optimal selection of these projects, models working around these fundamentals have been developed to assist decision makers.

2.2.1 Project Selection Models

Project selection models are used by decision makers during project pre-development phase to guarantee that only bankable projects that are commercially viable are selected. Project selection models are basically a representation of how projects can be prioritized and selected by allowing for the investigation of factors affecting the process of project selection and, in some cases, prediction of future outcomes. Models are often used in quantitative analysis and technical analysis, and sometimes can be used in fundamental analysis (Meredith & Mantel Jr, 2009). Decision makers use models to extract the relevant aspects of a problem from the details in which it is embedded.

Decision or screening models for evaluating and selecting potential projects in renewable energy can range from simple qualitative to complex quantitative considerations. Different organisations have developed screening model that allow them to make the best choices among alternatives within the usual constraints of time and money. Models represent the problem's structure and can be useful in selecting and evaluating projects.

According to Souder (1984), there are six important issues that managers ought to consider when evaluating project screening models. These critical factors being realism, capability, flexibility, ease of use, cost and comparability.

i. *Realism*: An effective model must reflect organizational objectives, strategic goals, and mission. It must take into account the constraints on resources such as money and availability of personnel. The model must also consider the existing commercial and technical risks, including performance, cost, and time.

ii. *Capability*: A model should be flexible enough to respond to changes in the conditions under which projects are carried out. It should be robust enough to accommodate new criteria and constraints, and should be able to simulate different scenarios and optimize the decision to cover the greatest possible range of project types.

iii. *Flexibility*: The model should be easily modified if trial applications require changes. It must have ability to provide valid results within a range of conditions.

iv. *Ease of Use***:** A model must be simple enough to be used by people in all areas of the organization, both those in specific project roles and those in related functional positions. The choices made for project selection, and the reasons for those choices should be clear and easily understood by organizational members. The model should allow users to generate the screening information rapidly and assimilate that information without any special training or skills.

v. *Cost***:** The screening model should be cost effective, the cost of obtaining selection information and generating optimal results should be low enough to encourage use of the models rather than diminish their applicability.

vi. *Comparability***:** It must be broad enough to be applied to multiple projects. If a model is too narrowly focused, it may be useless in comparing potential projects or foster biases toward some over others. A useful model must support general comparisons of project alternatives.

In literature, models are broadly classified as numerical or non-numerical.

2.2.1.1 Non-Numerical Models.

Non-numerical models consider broader aspects such as market share, political issues and client perception. The focus of non-numerical methods is based on social benefit. This means projects are undertaken for the good of society. In developing countries, non-numerical models are exploited by politicians who in turn earn political support from citizens based on the number and size of projects they undertake. Common among these models in use within developing countries are (Meredith & Mantel Jr, 2009):

i. *The Operating Necessity Model*: This model is used where projects are initiated because they are required to keep the system in operation. An example for this type of project is the building of a bridge across a river by government to ease access for the people living on the other end of the river or building a school or hospital in an area to cut down on the distance people must walk to access these services. Other situations where the operating necessity models can be used are during life threatening situations such as floods, drought, and landslides.

ii. *The Sacred Cow Model:* is another example of a non-numerical model: Under this model, the will of the "Boss", usually, a senior and powerful individual in an organization or even the owner is what must happen. He will identify the project and influence every stage of the project until successfully concluded, or until the boss, personally, recognizes the idea as a failure and terminates it.

iii. *The Competitive Necessity Model*: Under this model, projects are initiated and given a lot of support if they will help an organization to maintain a competitive edge over other organizations. An example of the competitive necessity model could be an exercise to rebrand so as to remain competitive in the market. Regardless of the processes, the decision to undertake the project is based on the desire to maintain a company's competitive position in that market.

iv. *The Product Line Extension Model:* This model is used in product development and distribution line of projects. It is especially useful where the project is intended to fill a gap or to strengthen a weak link or to take the organization to a new direction. Under this model, a project to develop and distribute new products would be judged by the extent to which it fits the firm's existing product line, fills a gap, strengthens a weak link, or extends the line in a new, desirable direction. Decision makers base their decision on the likely impact on the total system performance if the new product is added to the line.

v. *Comparative Benefit Method*: This model is used when an organization has many projects to consider, perhaps several dozen. Senior management would like to select a subset of projects that would most benefit the firm, but the projects under consideration do not seem to be easily comparable. For example, some projects concern rolling out new communication sites, some concern a rollout of an alarm monitoring system, change of payroll system, others concern computerization of certain records and still others cover a variety of subjects not easily categorized such as creating a database of beneficiaries to the medical scheme offered by the organization. There is no formal method of selecting such projects in the organization, but the selection committee members think that some projects will benefit the firm more than others, even if they have no precise way of defining or measuring the benefits that would accrue to the organization. After selecting their choice, the committee submits to senior management of the funding organization. They in turn examine all projects with positive recommendations and attempt to construct a portfolio that best fits the organization's aims and budget. The projects are then ranked and selected for implementation. This may be carried out by one person who is responsible for evaluation and selection, or it may be performed by a committee charged with that responsibility. If a committee handles the task, the individual rankings can be developed anonymously, and examined by the committee itself for consensus. Differences are expected but they do not often vary strikingly because the individuals chosen for such committees rarely differ widely on what they feel to be appropriate for the parent organization. Projects can then be selected in the order of preference, though they are usually evaluated financially before final selection.

2.2.1.2 Numerical Models

Numerical models in project selection are heavily depended upon when it comes to selecting projects other than non-numeric models, which are deemed to be very subjective and unscientific (Meredith & Mantel Jr, 2009). Numeric models are broadly classified in two types namely profit and profitability models and scoring models.

i. *Profit / profitability models* are also known as capital budgeting techniques. The traditional approach to capital budgeting encompasses three steps, namely (1) estimating the incremental free cash flows of a planned project or investment (2) choosing a discount rate and (3) recognizing and adjusting the decision technique for risk. Capital budgeting techniques are categorized in two: 'certainty' and 'uncertainty'. The techniques under 'certainty' are further broken down into non-discounted cash flows and discounted cash flow. Under non-discounted cash flows there is the Payback period method (PBP) and the Accounting Rate of Return (ARR). A graphical representation of numerical models is shown in Fig 2.1.

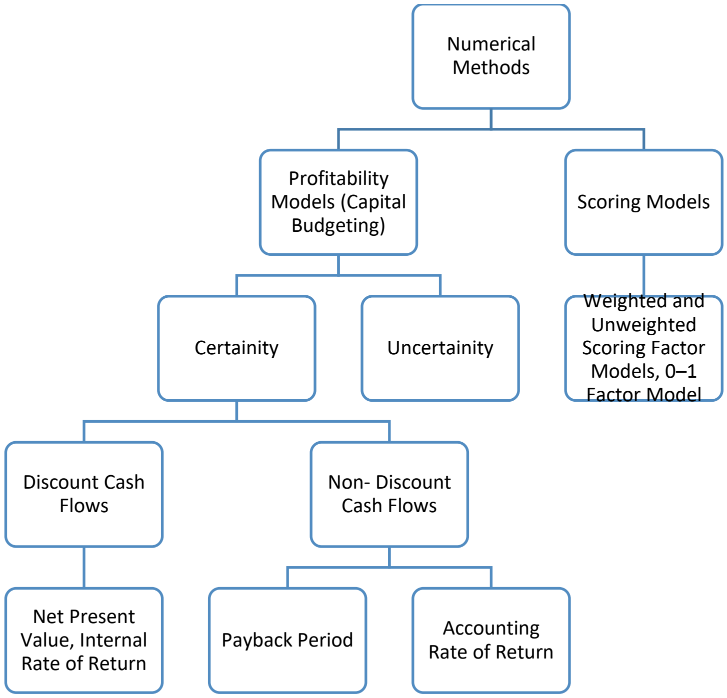

Fig 2.1 Breakdown of Numerical models

a) Pay Back Period (PBP)

PBP is the simplest and perhaps, the most widely used quantitative method for appraising capital expenditure decision (McDonald, 2006). Payback period method simply looks at the number of years required to recover the original cash outlay invested in a project. There are two methods in calculating PBP. The first method can be applied when the annual cash flow is constant. In such a situation the initial cost of the investment is divided by the constant annual cash flow (CFAT).The investment decision criteria for this technique suggests that if the calculated payback period is less than some maximum value acceptable to the company, the proposal is accepted. The second way of calculating PBP is when a project's constant annual cash inflows are not equal. In such a situation PBP is calculated by the process of cumulating CFAT till the time when cumulative cash flow becomes equal to the original investment outlay.The PBP can be used as a decision criterion to select investment proposal. If the PBP is less than the maximum acceptable payback period, then the project is accepted. If the PBP is greater than the maximum acceptable payback period, a decision should be taken to reject the project. This technique can be used to compare actual pay back with a standard pay back set up by the management in terms of the maximum period during which the initial investment must be recovered. The standard PBP is determined by management subjectively, on the basis of a number of factors such as the type of project, and the perceived risk of the project. PBP can be used for ranking mutually exclusive projects. The projects may be ranked according to the length of PBP and the project with the shortest PBP will be selected.

b) Accounting/Average Rate of Return (ARR)

Accounting/Average Rate of Return method also known as the return on investment (ROI) or return on capital employed (ROCE) uses accounting information rather than cash flow. The ARR is the ratio of the average after tax profit divided by the average investment. The ARR can be used as a decision criterion to select investment proposal. If the ARR is higher than the minimum rate established by the management, accept the project else reject the project.

c) Net Present Value (NPV)

The net present value (NPV) is one of the discounted cash flow or time-adjusted technique. It recognizes that cash flow streams at different time period differs in value and can be computed only when they are expressed in terms of common denominator such as present value. The NPV is the difference between the present value of future cash inflows and the present value of the initial outlay, discounted at the firm's cost of capital. The procedure for determining the present values consists of two stages. The first stage involves determination of an appropriate discount rate. With the discount rate, so selected, the cash flow streams are converted into present values in the second stage The Net present value method can be used as an accept-reject criterion. The present value of the future cash streams or inflows would be compared with present value of outlays. If the NPV is greater than 0, a decision should be taken to accept the project. If the NPV is less than 0, a decision should be taken to reject the project.

d) Internal Rate of Return (IRR)

This technique is also known as yield on investment, marginal productivity of capital, marginal efficiency of capital, rate of return, and time-adjusted rate of return. It also considers the time value of money by discounting the cash flow streams, like NPV. While the computation of the required rate of return and present value of cash flows-inflows as well as outflows- are not considered, the IRR depends entirely on the initial outlay and the cash proceeds of the projects which are being evaluated for acceptance or rejection. It is, therefore, appropriately referred to as internal rate of return. The IRR is usually the rate of return that a project earns. The internal rate of return (IRR) is the discount rate that equates the NPV of an investment opportunity. It is the compound annual rate of return that a firm will earn if it invests in the project and receives the given cash inflows.

The IRR is used to make accept-reject decisions. If the IRR is greater than the cost of capital, a decision should be taken to accept the project. If the IRR is less than the cost of capital, a decision should be taken to reject the project.

2.3 Critical Factors in Decision Making for Renewable Energy

Potential investors in the field of renewable energy have vested interest which they must protect by all means and will only put their stakes on investment for which they are sure to reap benefits. Whereas the Government may be politically motivated (driven) by the need to improve the social economic status of its citizens, private investors may be interested in having a return on their investment. The question then is how do they decide on what project to invest? What are some factors to consider in arriving at their choices? Literature gives us some insight into how they do so. Driving forces or factors for project selection identified in literature (Klein, 1998; McClung, 2002; Laura, 2006, Meredith et al, 2009; Khadija and Laila, 2015) include among others, the following:

i. Balance between business units served
ii. Risk profile of portfolio
iii. Project/technical risk
iv. Value add/Net Present Value/Internal Rate of Return
v. Available budget
vi. Project Cost
vii. Period for Implementation
viii. Payback period
ix. Synergy effects between projects
x. Personnel resources/capabilities
xi. Social, political and environmental issues
xii. Job creation/wealth creation
xiii. Strategic alignment/Leverage
xiv. Intellectual property issues
xv. Culture
xvi. Process
xvii. Knowledge of the business
xviii. Knowledge of the work
xix. Education
xx. Experience
xxi. Risk awareness

xxii. Governance

xxiii. Selection of players

xxiv. Preconceptions

xxv. Time pressures

xxvi. Policy in place

The list, though not exhaustive, highlights generic factors that can influence decision making in this critical industry. Meredith and Mantel (2009) suggest that the factors to selecting a model for project selection be broadly classified in five categories namely: (1) production (2) marketing (3) financial (4) personnel and (5) administrative and miscellaneous categories. Table 2.1 provides more details of the five categories.

Table 2.1 – Project Selection Factors

Production Factors 1. Time until ready to install 2. Length of disruption during installation 3. Learning curve—time until operating as desired 4. Effects on waste and rejects 5. Energy requirements 6. Facility and other equipment requirements 7. Safety of process 8. Other applications of technology 9. Change in cost to produce a unit output 10. Change in raw material usage 11. Availability of raw materials 12. Required development time and cost 13. Impact on current suppliers 14. Change in quality of output Marketing Factors 1. Size of potential market for output 2. Probable market share of output 3. Time until market share is acquired 4. Impact on current product line 5. Consumer acceptance 6. Impact on consumer safety 7. Estimated life of output 8. Spin-off project possibilities Financial Factors 1. Profitability, net present value of the investment 2. Impact on cash flows 3. Payout period 4. Cash requirements 5. Time until break-even 6. Size of investment required 7. Impact on seasonal and cyclical fluctuations	Personnel Factors 1. Training requirements 2. Labor skill requirements 3. Availability of required labor skills 4. Level of resistance from current work force 5. Change in size of labor force 6. Inter- and intra-group communication requirements 7. Impact on working conditions Administrative and Miscellaneous Factors 1. Meet government safety standards 2. Meet government environmental standards 3. Impact on information system 4. Reaction of stockholders and securities markets 5. Patent and trade secret protection 6. Impact on image with customers, suppliers, and competitors 7. Degree to which we understand new technology 8. Managerial capacity to direct and control new process

Source: adapted from: Meredith and Mantel 2009

In their study into strategic project selection for construction projects of the Ministry of Defence in Thailand, Puthamont and Charoenngam (Puthamont & Charoenngam, 2007) discovered that these factors are different for each phase of a project. For the concept phase, the most important factors are project objective; project rationale; and mission of the organization. For the design stage, the most important factors are: readiness to implement; conformance to regulations and the law; and project budget. For the final approval stage; factors include project objective; action plan; and project rationale. The study of these factors clearly illustrate that no single project decision need include all these factors; nor are all elements of equal importance but there is variation according to application. This finding is supported by other studies conducted on project selection (Astebro, 2004)

2.4 Project Portfolio selection

Project Portfolio selection is a complex process that involves a careful selection of projects deemed to be contributing to the strategic goals and objectives of an organization. It involves evaluating individual projects or groups of projects and then choosing to implement a set of them so that the objectives of the parent organization can be achieved. Organisations that balance their project portfolio and optimize their decision making save resources by embarking only on critical projects. They can avoid spending resources on competing projects, avoid duplicating efforts, drop projects whose costs exceed their benefits and are in a better position to handle projects with high risk. They are also able to identify proposed projects that are not really projects and should be handled through other processes, prioritize the list of available projects, keep from overloading the organization's resource availability, balance short-term, medium-term, and long-term returns and balance the resources with the needs. Various models have been developed to smooth out the process. Among these is the model developed by Archer and Ghasemzadeh (Archer &Ghasemzadeh, 1999) and Murray et al. (Murray, Burgher, & Alpaugh, 2009). Figure 2.2 shows the framework for portfolio selection.

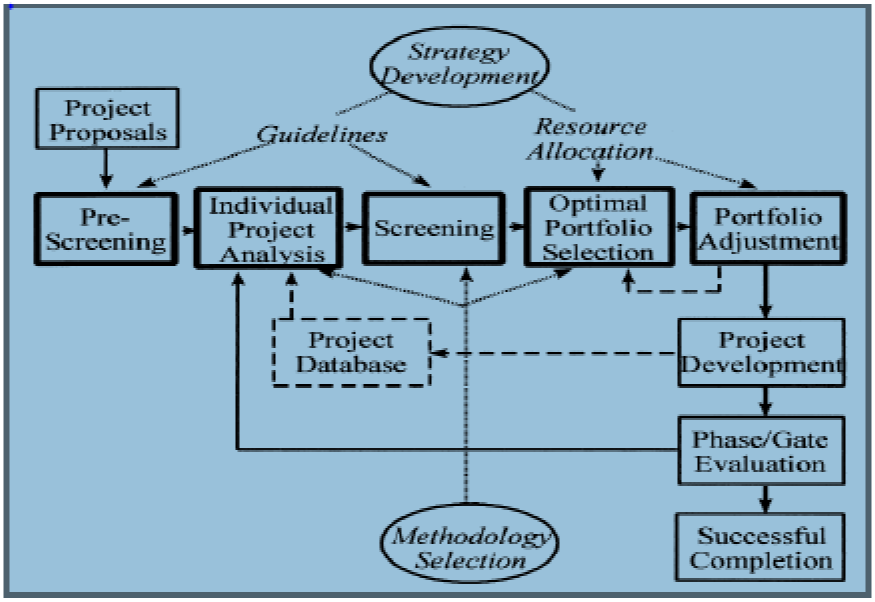

Figure 2.2 Framework for project portfolio selection (Archer and Ghasemzadeh, 1999)

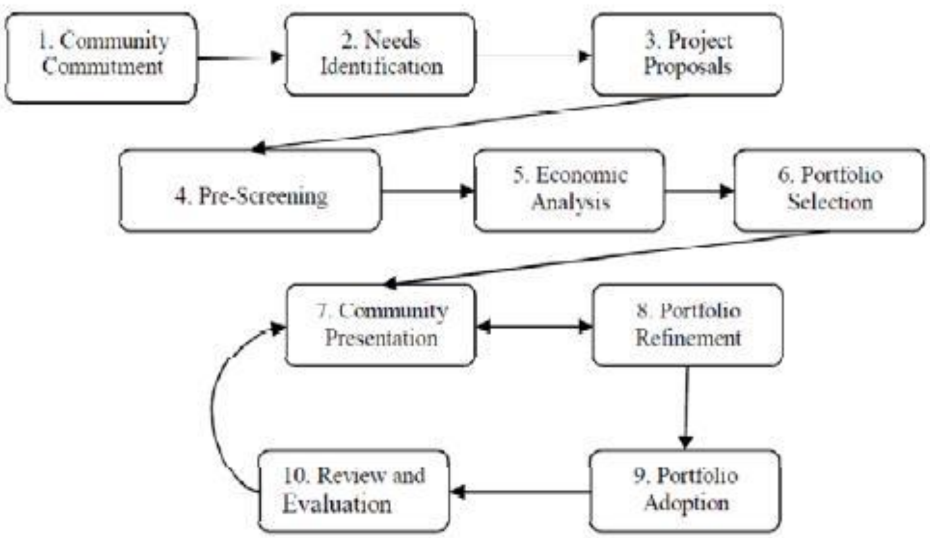

Figure 2.3 Project selection approach (Murray et al. 2009)

Both Archer's framework shown in Figure 2.2 and Murray's approach indicated in Figure 2.3 separate the work into distinct stages, with each stage accomplishing a particular objective and feeding to the next stage. They include continuous refinement and feedback loops.

Murray's approach has been applied for public private partnerships projects. It includes a link to needs identification and in response to the nature of public sector economic development projects, the community. In this case, the community is engaged in the first 3 steps. Then economic analysis involving quantitative and qualitative methods is applied. During the portfolio selection stage, Murray suggests the use of Analytical Hierarchy Process (AHP) to compare the remaining projects and rank them per selected weighted attributes. The AHP process is also suggested by Archer and Homemade (Archer & Ghasemzadeh, 1999) for use in the project selection stage of their process. The AHP process developed by Saaty (Saaty, 2008) includes three major steps: (1) identify and select criteria; (2) weight the criteria and build consensus about their relative importance; and (3) evaluate the project proposals using the weighted criteria. Portfolio refinement in step 8 of Murry's framework, is an important step in this iterative process where the views and decisions of the community are reflected upon.

Longman (Longman et al, 1999) and Englund (Englund & Graham, 1999) proposed an eight step process (as highlighted below) for selecting, implementing, and reviewing projects that will help an organization achieve its strategic goals:

i) Establish a project council;
ii) Identify project categories and criteria;
iii) Collect project data;
iv) Assess resource availability;
v) Reduce the project and criteria set;
vi) Prioritize the projects within categories;
vii) Select the projects to be funded and held in reserve; and
viii) Implement the process

2.5.1 Project Portfolio Selection models

Models adopted for portfolio selection differ in sophistication and level of application. Different Organisations have adopted and naturalized these models to suit their needs. According to Pinto (Pinto, 2016), a good model is one that can generate useful information for project choices in a timely and useful fashion at an acceptable cost. It must endeavor to help an organization in making optimal choices among numerous alternatives available. The most common models include:

financial methods; business strategy; scoring Models; bubble diagrams and check lists (Pinto et al, 2016, (Cooper & Edgett, 2001)) *a) Financial Methods*

Financial methods as discussed under project selection models include various profitability and return metrics, such as Net Present Value (NPV), Internal Rate of Return (IRR), Return on Original Investment (ROI), Return on Average Investment (RAI), Payback Period (PBP), and Expected Value (EV). Financial models remain the dominant and most used method under project portfolio selection. Their primary focus is on the financial value of projects. While this is their strength, it is also their Achilles heel due to the fact that critical factors relating to risk and strategic goals of the organization are overlooked. Therefore, depending solely on them can lead to bad decision making.

b) Business Strategy Models

Under this model, money is allocated and bucketized across different types of projects as defined by a given, company's strategy. Projects are then placed in these buckets and are retained within the limits of the capacity of each bucket. The units used to split spending into buckets are similar to those described by Meredith & Mantel (2009) i.e.: type of market; type of development; product line, project magnitude, technology area and others. This method has a lot of advantages compared to the financial models discussed above according to Cooper & Edgett. Foremost of these advantages is that: Projects are aligned with the business strategy as they match to strategic objectives of the business, expenditures reflect the company's strategy and the number of projects selected is consistent with the company's capacity to undertake such projects. However, this either is not a perfect model as the bucketizing of projects does not follow a formal method, (Cooper & Edgett, 2001).

c) Scoring Models

Scoring models are a special kind of predictive models whereby projects are rated or scored on a number of questions or criteria such as low-medium-high; or 1-5 or 0-10 scale. The ratings on each scale are then added to give the Total Project Score, which becomes the criterion used to make project selection and ranking decisions. The importance of the projects is distinguished by assigning each criterion a weight. The choice of projects reflects the desire to maximize the impact of certain criteria on the decision. The choice of criteria and their weightings depend on the company's strategy. The most used criteria include strategic fit; financial reward; risk and probability of success; timing (Cooper & Edgett, 2001). This model is easy to use and to tie critical strategic goals of the company to various project alternatives.

d) Bubble Diagrams

Bubble Diagram models allow managers to plot risk-return profile for each project under consideration and then select the project that maximizes return while staying within a certain range of minimum acceptable risk. Projects are then split in the quadrants: high risk-less return, Low risk- high return, high risk -high return and less risk less return. The superiority of Bubble diagrams over other models lie in the fact that they can portray the entire portfolio in visual format, and are also able to display portfolio balance. Like the scoring models, they are easy to understand and use (Pinto et al, 2016).

e) Check List Model

Under this model, projects are evaluated on a set of Yes/No questions relating to the criteria chosen by the company. To be considered for selection, each project must achieve either all Yes answers, or a certain number of Yes answers to proceed. The number of Yes's is used to make decisions. Answers to questions can also be ranked as: high, medium, or low in order to see which project accumulates the most positive checks and may thus be regarded as the optimal choice (Pinto et al, 2016; Cooper & Edgett, 2001).

Hybrid models have been proposed and used in some cases. According to Khadija (Khadija & Laila , 2015) a hybrid model which combines two or more of the above discussed can lead to a reaping of more benefits that come from the advantages of each model. In their discussion on project selection methods DeMaio et al. (De Maio, Verganti, & Corso, 1994) agree with Khadija's thought that, rather than looking at these models as mutually exclusive, they ought to be considered as complementary because no optimal method exists as these techniques are evaluated and chosen according to the specific application. Furthermore, the effectiveness of this decision-making process can be influenced by pathophysiological factors - human psychological factors and the environment (Dunstall, 2009); organizational and cultural considerations (Brooks, 1994); the quantum (whether too much or too little) and timeliness of information to assist the decision making (Katopol, 2007); and the experience of the decision makers (Brockmann and Anthony, 2002).

Archer and Ghasemzadeh (Archer & Ghasemzadeh, 1999) identify and associate the problems with project portfolio selection as resulting from: (1) conflicting objectives, (2) unclear objectives that might be impossible to Quantify, (3) uncertainty and risk associated with the project, (4) the selected unbalanced portfolio in terms of important factors, such as risk and time to completion,
(5) interdependence of projects and (6) too many portfolios adopted. Additionally constraints such as finance, work force, and facilities or equipment, are to be considered.

Researchers, Archer and Ghasemzadeh (Archer & Ghasemzadeh, 1999) bring to the fore that if resource limitations are not formally included in the project portfolio process, portfolio selection becomes more complex and difficult when resource availability and consumption are not uniform over time. And this is a common dilemma for most organizations. There is certainly is no consistency in approach to the selection of projects and there are many factors that contribute to optimal project portfolio selection, and decision making on investment projects.

There are a number of decision models available in literature for use by managers responsible for evaluating and selecting potential projects. These models range from qualitative and simple to quantitative and complex. All firms, however, try to develop their own screening model or set of models that will allow them to make the best choices among alternatives within the usual constraints of time and money. Researchers, scholars and existing body governing project management agree that there exist many models on which decision makers can draw.
The Project Management Institute (PMI) standard for portfolio management (2008) for example suggests a process for portfolio governance involving the following seven steps: (1) project components identification, (2) component categorization, (3) component evaluation, (4) selection components, (5) prioritization of these components, (6) balancing of project portfolio and (7) authorized components.

Researchers Archer and Ghasemzadeh (Archer & Ghasemzadeh, 1999) developed a somewhat similar process they called ‘framework for project portfolio selection’ which is basically an integrated framework that incorporated a sequence of phases: strategic consideration; project evaluation; and portfolio selection. Authors Cooper & Edgett, suggests that there are well over 100 different models available for qualitative as well as quantitative evaluation and prioritization of projects. DeMaio et al (1994) suggests that techniques be evaluated and chosen according to the specific application and that the methods not be considered mutually exclusive but rather as complimentary techniques.

Companies need to have a systematic approach in the way they select their projects for their portfolio. Many firms have developed sophisticated methods for screening and selecting the projects to ensure that the chosen projects when funded will offer the best promise of success. If right projects are selected, companies will thrive and remain competitive among their peers and competitors. Opportunities are lost if the wrong projects are chosen and resources are not concentrated on what the company needs in order to serve its markets in the best possible way, with the most appropriate product of the best possible quality. If strategically less important projects are not excluded early enough from the project pipeline, management and resource allocation of the project portfolio become more complex than is necessary. Furthermore, it prevents important projects from being executed with the highest possible efficiency. It is believed that this would result in a loss of focus and therefore potential shortcomings in the marketplace.

2.5 Summary

In this chapter, literature on police as it relates to energy in Zambia has been considered along side the considerations to be taken when selecting projects in the predevelopment stage. Other range of literature include practices in project portfolio selection, and how it is applied. The information gathered so far has revealed also the strides government is has taken in readiness for the renewable energy deployment in Zambia. Various project selection models and frameworks currently used include a wide range of tools and techniques involving quantitative and qualitative methods, were identified. The next chapter focuses on the methodology used for this study.

CHAPTER 3: METHODOLOGY

3.1 Introduction

The previous chapter looked at various literatures on the selection of projects and portfolios. This chapter focuses on the methods that were used to achieve the objectives of this research.

3.2 Research onion model

In order to understand the research process, the onion ring model was used as shown in the figure 3.1.

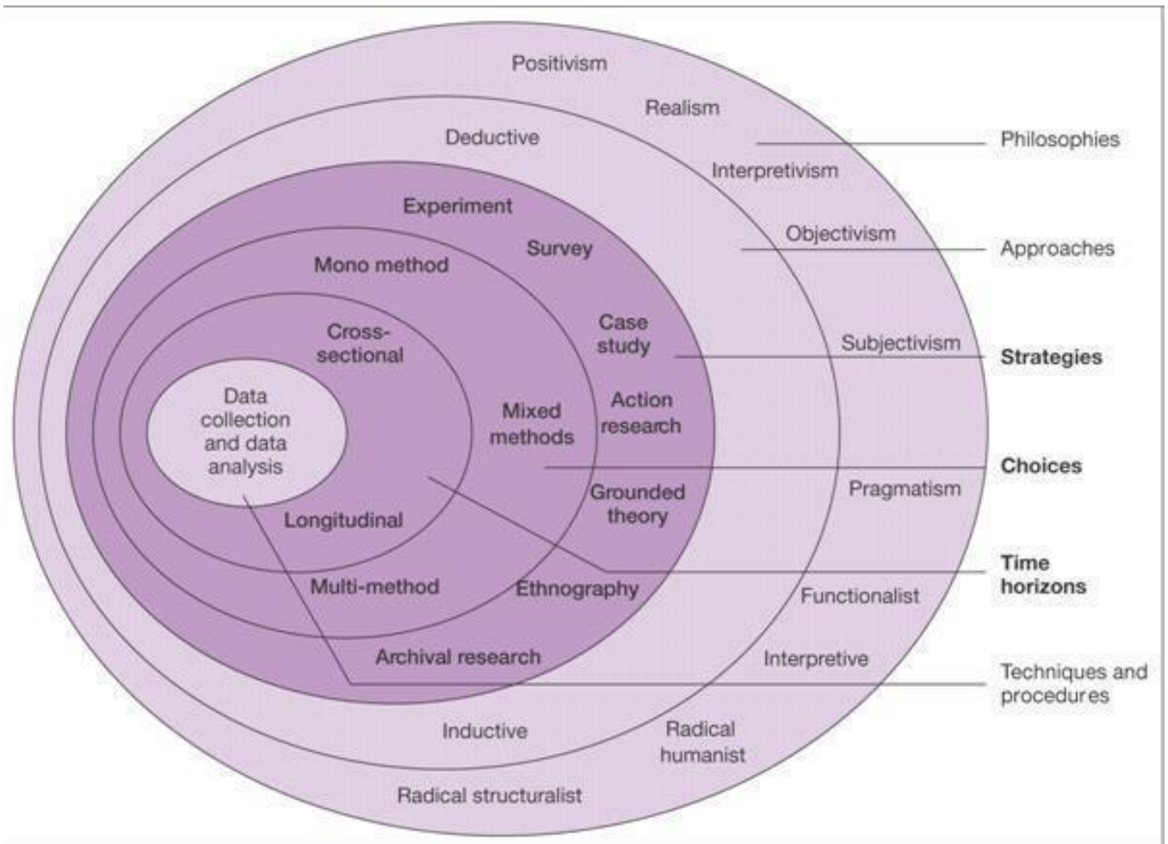

Figure 3. 1 Research onion ring model (Source: Saunders et al, 2007)

The research onion creates a series of stages under which the different methods of data collection can be understood, and illustrates the steps by which a methodological study can be described. It describes the stages through which the researcher must pass when formulating an effective methodology. From the outermost shell to the core, the stages of research are well outlined.

Research philosophy is the starting point of the research and is in the first shell followed by the research approach in the second step. The third step describes the research strategies. The fourth layer identifies the time horizon and the fifth step represents the stage at which the data collection methodology is identified

3.2.1 Research Philosophy

There are many different research philosophies available but three of the most popular ones are Positivism, interpretivist and Post-Positivism. Positivism as an epistemological (how we know that world) approach explains causal relationships using scientific methods based on logic and mathematics. Positivism approach is characterized as empirical, quantitative, rigid, measuring the world around us as comprising of immutable objects and structures. With this type of philosophy, a wide range of social phenomena, including feelings and subjective viewpoints can be investigated. Post-positivism takes a more pragmatic approach where pluralistic, subjective, moral and political issues could be examined to gain knowledge in relation to the objective stance in the past. It moves beyond positivist epistemologies to attain new knowledge that is not constrained by the traditions of a positivist. Interpretivism approach aims to study people, particularly in social science. It starts from position that the subject matter is inherently different from non-human subjects. Table 3.1 sums up the paradigmatic or philosophical issues in research approaches.

The renewable energy sector and the process of selecting projects and their portfolio upon which this study is based exists externally and are not related to the researcher; this being the case, Easterby-Smith et al. (2012) suggest that results in such a situation be measured through objective methods rather than being inferred subjectively through reflection, sensation or intuition. The study adopts a post-positivist philosophical approach because credible data could only be derived through a combination of quantitative and qualitative analysis of phenomena observed (Saunders, Lewis, & Thornhill, 2007). The social interpretivist philosophy, which aims to study and reflect on the inner feelings of participants, is only partially being utilized in this study, due to the study's research objective, which is to ascertain the effectiveness of project selection criteria in different organizations.

Table 3.1: Summary of three popular research approaches

PHILOSOPHY	BRIEF DESCRIPTION	TYPE OF DATA/DATA COLLECTION	ONTOLOGY	EPISTEMOLOGY
Positivism	Aims to mirror scientific method. Uses deductive reasoning, empirical evidence and hypothesis testing	Quantitative data, surveys based on scientific methods, larger sample sets, numeric	The world is objective and independent of our subjective experience	The world is knowable, and this knowledge is communicable between agents
Interpretivism	An approach to studying people, particularly in social sciences, that starts from position that the subject matter is inherently different from non-human subjects.	Qualitative data, subjective experience, small numbers of respondents, detailed examinations, textual	The world is dependent on the many subjective experiences of that world, and does not exist independently of experience	There is no possibility of 'objective' knowledge of the world, all we have are different experiences.
Post-Positivism	Shares the main assumptions of positivism, but takes a more relativistic perspective	Quantitative, qualitative, mixed methods	There is an objective world, but knowledge of it is filtered through the subjective experience of individuals. Knowledge is by its nature partial and bound by individual experience	

3.2.2 Research Approach

The types of research approaches are deductive and inductive.

a) Deductive Approach

Deductive Approach develops the hypothesis or hypotheses upon a pre-existing theory and then formulates the research approach to test it (Silverman, 2013). This approach is best suited to contexts where the research project is concerned with examining whether the observed phenomena fit with expectation based upon previous research (Wiles et al., 2011). The deductive approach thus might be considered particularly suited to the positivist approach, which permits the formulation of hypotheses and the statistical testing of expected results to an accepted level of probability (Snieder & Larner, 2009). However, a deductive approach may also be used with qualitative research techniques, though in such cases the expectations formed by pre-existing research would be formulated differently than through hypothesis testing (Saunders, Lewis, & Thornhill, 2007). The deductive approach is characterized as the development from general to particular. The general theory and knowledge base is first established and the specific knowledge gained from the research process is then tested against it (Kothari, 2004).

b) Inductive Approach

Inductive approach is characterized as a move from the specific to the general (Bryman & Bell, Business research methods, 2011). In this approach, the observations are the starting point for the researcher, and patterns are looked for in the data (Beiske, 2007). In this approach, there is no framework that initially informs the data collection and the research focus can thus be formed after the data has been collected (Flick, 2011). Although this may be seen as the point at which new theories are generated, it is also true that as the data is analyzed that it may be found to fit into an existing theory (Bryman & Bell, Business research methods, 2011). This approach is more commonly used in qualitative research, where the absence of a theory informing the research process may be of benefit by reducing the potential for researcher bias in the data collection stage (Bryman & Bell, 2011). Interviews are carried out concerning specific phenomena and then the data may be examined for patterns between respondents (Flick, 2011). However, this approach may also be used effectively within positivist methodologies, where the data is analyzed first and significant patterns are used to inform the generation of results.

The study involves discovering what is at the heart of decision makers. It considers how and why decisions are made. These can only be discovered in the pattern of the data collected and analyzed. This research is about discovering the patterns in decision making. Looking at the approaches described here, the best research approach for this kind of study is inductive approach. This approach takes into account the most common view of the relationship between theory and research and results gotten from this approach are developed through logical reasoning (Bryman & Bell, 2011). The data findings are examined to discover the trends in decision making and checked for consistence in different organization pursuing similar projects. Most of the data looked at the common practice in industry when it came to selecting projects and creating portfolios in the renewable energy sector or already been made.

3.2.3 Research Strategy.

Having justified the approach to be taken for this research, the way of collecting data and why the preferred method was the next step. The adopted research paradigms guides the strategy used in this study. The onion ring in figure 3.1 shows the common research strategies.

a) Survey studies

This type of research is usually inductive in nature and empirical. In this strategy, data is collected from large group of objects in a standardized and systematic way then evaluated using statistical methods to identify patterns, especially those which were not expected, and the results interpreted by the researcher. The common techniques employed for collecting data include observation, measurement, construction, questionnaires, interviews, literature research. The interpretation of data can either be Quantitative if the interest of the study is aspecific frequency, timing or number of events. It is Qualitative if certain behaviors are the areas of interest in the study, (Bryman & Bell, 2011)

b) Experiment

The goal of this strategy is to test a hypothesis using benchmarking or statistical significance tests. The researcher will formulate a hypothesis, collect evidence test hypothesis based on the evidence gathered. Experiments are best used when the paradigm of research selected is that of positivist, deductive, quantitative. Experiment research seeks to verify the existence of a problem, ensure validity of claims by careful design and check for repeatability of results. (Saunders et al, 2007)

c) Case studies

The case study method though popular for qualitative analysis, is also suitable where the research paradigm chosen is that of interpretivist, inductive, empirical. The goal in this strategy is to examine the characteristics of a real-life instance through a careful and complete observation of a social unit, be that unit a person, a family, an institution, a cultural group or even the entire community. The case study places more emphasis on the full analysis of a limited number of events or conditions and their interrelations. This makes it suitable for studies requiring intensive investigation of the particular unit under consideration. The techniques for data gathering include interviews, discussions, observations, questionnaires (Bryman, 2012; Silverman, 2013).

d) Participatory action research

This strategy seeks to iteratively solve a problem with a community of practice. It consists typically of three stages namely planning, execution (action) and reflection (evaluated). In the planning stage the problem is analyzed and a solution is developed with the help of existing theories and action plans. In the second stage the solution is implemented and in the third stage it is evaluated to derive design principle(s). This research strategy is suitable for the paradigm of interpretivist, constructive, qualitative. (Bryman, 2012)

e) Grounded theory

Grounded theory is a qualitative methodology that draws on an inductive approach whereby patterns are derived from the data as a precondition for the study (May, 2011). For example, interview data may be transcribed, coded and then grouped accordingly to the common factors exhibited between respondents. This means that the results of the research are derived fundamentally from the research that has been completed, rather than where the data is examined to establish whether it fits with pre-existing frameworks (Flick, 2011). Its use is common in the social sciences (Bryman, 2012).

f) Ethnography

Ethnography is the study of people in their natural occurring settings so as to capture their social meanings and ordinary activities. The researcher is actively involved in the setting, or the activity records his experience and interprets the environment as he experiences it. The goal of ethnography then is to give an analytical description of the social culture or explore a particular phenomenon, rather than the testing of a hypothesis. Clearly this strategy is suitable for interpretivist, qualitative paradigm (Bryman, 2012).

g) Archival research

As the name suggest, archival research is a form of primary research that looks into and extracts evidence from original archival records. These records may be held either in institutional archive repositories which include electronic databases, emails, and web pages, or in the custody of the organization (whether a government body, business, family, or other agency) that originally generated or accumulated them, or in that of a successor body. In its classic sense, archival methods involve the study of historical documents. However it has been used by scholars engaged in non-historical investigations of documents and texts produced by and about contemporary organisations documents. The goal of this research strategy is to analyze patterns of existing research and establish the sum of knowledge on a particular study, or to examine the application of existing research to specific problems. The onion ring places this type of research as one that fits the paradigm of a radical structuralist or humanist and is inductive in nature, (Flick, 2011). Other researchers (Jon, 2006; Suzanne et al, 2004) have recommended strategies other than those prescribed in the onion ring model for managerial decision-making and for forecasting. One such model in particular is the Delphi model which was developed by Dalkey and Helmer (1963).

3.2.4 Data Collection

The Delphi technique

The Delphi technique is a widely used and accepted method for gathering data from respondents who are subject-matter experts. The technique is designed as a group communication process which aims to achieve a convergence of opinions on a specific real-world subject. The Delphi method is characterized by the following four key features which are designed to offset the shortcomings of conventional means of pooling opinions obtained from a group interaction such as:

(i) The influences of dominant individuals:

Anonymity of participants reduces the effects of dominant individuals which often is a concern when using group-based processes used to collect and synthesize information.

The geographic dispersion of the subjects as well as the use of electronic communication such as e-mail to solicit and exchange information guarantees the issues of confidentiality in the process

(ii) Noise:

Iteration allows the Delphi participants to fine tune their views as clarity on the subject improves with different views from other participants.

(iii) The inconsistencies of response

The feedback process which allows and encourages the selected panelist to reassess and modify their initial judgments on the subject provided in previous iterations.

(iv) Group pressure for conformity:

Statistical analysis techniques which allow the use of quantitative methods on the opinions generated by each subject of a Delphi study and reduce biasness.

Due to the features discussed above, the Delphi process has been quite useful in various fields of study such as needs assessment, policy determination, program planning, and resource utilization to create full range of options, explore or expose underlying assumptions, as well as correlation of judgments on a topic spanning a wide range of disciplines. Theoretically, like any other iterative process, the Delphi process can be continuously iterated until convergence is achieved.

However, studies by Rodney, Joseph and Bob (Rodney et al, 1999) show that three iterations are often sufficient enough to collect the needed information and to reach a convergence point in most cases. The first of these three iterations or rounds begins with an open-ended questionnaire; soliciting specific information about a content area from the Delphi subjects. In the second round, each Delphi participant receives a second questionnaire and is asked to review the items summarized by the investigators based on the information provided in the first round. In the third round, each Delphi panelist receives a questionnaire that includes the items and ratings summarized by the investigators in the previous round and are asked to revise their own judgments.

There is a variation to the classic Delphi technique called the *Modified Delphi technique*. Proponents of the modified technique argue that convergence can be reached by single or double iterations or rounds (Skulmoski et al, 2007). In this instance, a combination of qualitative approach using in-depth interviews followed by a questionnaire-based survey is used to provide data that can be interpreted and analyzed to provide verification of earlier findings. This technique takes advantage of the possibility to use both qualitative and quantitative research methods by combining stages in the Delphi technique. Experts recommend the use of this technique in situations where there is incomplete knowledge about the subject of research, and where there are a limited number of experts available. Using this method, only a small number of subject-matter experts are required in a collective and iterative manner to provide necessary information. Of all the methods looked at above, it is the most suitable for this research considering the advantages advanced above and is therefore the adopted method.

3.3 Adopted Methodology

3.3.1 Study population

According to Chitu and Suzanne (2004), The Delphi group size does not depend on statistical power, but rather on group dynamics for arriving at consensus among experts. The decision about panel size is empirical and pragmatic, taking into consideration factors such as time and expense (Linstone, 1978). Linstone further suggests that "a suitable minimum panel size is seven" but panel sizes have ranged from 4 to 3000. Following this recommendation from literature, this research targeted nine (9) individuals in the renewable energy sector who are key decision maker within this sector, these include directors and managers.

3.3.2 Tools of data collection

a) Primary tools

A questionnaire was generated with the questions derived systematically by analyzing the different aspects of investment project portfolio selection relating to the research questions and propositions. These questionnaires were distributed to collect data from individuals in the renewable energy sector. These were self administered. The questionnaires contained close ended questions to obtain quantitative data and open ended questions to allow for additional qualitative information.

Interviews were used to collect data from key informants like decision makers. This allowed the research actual and factual information concerning the factors that guide them in decision making.

Data was collected in the environment in which participants in decision making in organisations operate in order to understand the current practices with regards to selection of investment projects and portfolios of projects. A list of open-ended questions was used to guide the interviews and ensure that all aspects of the research questions are covered during the discussions. To ensure uniformity among the different discussions undertaken, the researcher conducted the interviews personally. The interviews covered general prospects of the business to the details of project selection. Some of the data collected during interviews was supported by information published on the company website. The three quality-control principles, recommended by Yin (1994) namely (1) the use of multiple sources of evidence, (2) the creation of a survey database, and (3) maintaining a chain of evidence, were used to improve the accuracy, reliability and validity of collected data throughout the research. Access to internal data and communication within Zambian investment companies presented a challenge because of the nature of the information being confidential; as such data collection was based mostly on discussions with senior managers, participants in the process of project selection of organizations, internal documents compiled for meetings and publicly available material where possible.

b) Secondary Sources

Secondary sources of data included websites, journals, articles, books and company documents. These documents included for example process diagrams and documents depicting or listing the investment project portfolio of the company.

3.3.3 Data analysis

The data collected was interpreted with descriptive statistics using Microsoft Excel and used in the interpretation of the results and model development. Thematic and content analysis was also used during data analysis.

Literature review on project selection models, decision making, and portfolio management, as applied to investment projects in Zambia was done in order to understand the current and common criteria used in project selection. The data obtained was analyzed through classification techniques and content analysis.

3.4 Description of selected method

Two iterative interviews, the first being an in-depth walk-in interviews with experienced practitioners. Subsequent thematic analysis of the interview content allowed research questions RQ1 to RQ3 to be addressed, and identification of factors for further study in the second round.

The second round involved using a questionnaire which was completed by the same participants as in the first round, therefore exhibiting similarities to the Delphi technique. In combination with a thematic analysis of the responses from the participants, findings could be made to support the research conclusions.

Round 1 – Qualitative survey

The input for this round was the literature review.

The outputs of this round addressed the questions of: what represents best practice project Selection and what factors influence the process of selecting projects in this sector (Q1); examine the identified factors and determine why these factors are significant (Q2 and Q3). This information was used as input design of the questionnaire in round 2.The work required to achieve the round 1 outputs included: development of survey questions for use in the interviews; selecting and getting the nine participants to commit to the process; undertaking of in-depth interviews with the participants; recording and subsequent transcribing of interviews; collation of this data; and thematic analysis of data with respect to research questions and forming of common factors in project portfolio selection decision making.

Round 2 – Questionnaire

The inputs for this round were the literature review and findings from the previous round, particularly the common factors. The outputs of the round included addressing the research question on the contributing factors in project portfolio selection, and other key findings and recommendations from this research project.

The work required to achieve the round 2 outputs included: development of questionnaire; distribution of questionnaire and management of participants to obtain responses; interpretation and thematic analysis of data; development of findings.

More detail on the design of each Round, profile of the participants, analysis and findings are included in Chapter 4.

3.5 Limitations

Due to some issues beyond the researchers control, this research had a number of limitations that could have presented difficulties in collecting data. One of these was difficulties in gaining access to respondents who participated in the selection of projects and portfolios in their respective organizations.

The willingness and capacity of staff to answer questions with relation to criteria used in the selection process was also impeded. Some staff were not be willing to discuss sensitive issues such as their personal views on the Therefore, the list of participants was limited to a small number. This sample size influenced the ratings due to the fact that had the size been larger, there would have been more conclusive results on the factors that influence decision making across all the sectors. There is also a secondary limitation with regards to the experience of those staff that participated in the interviews. The ideal participants were typically participants who had been working in the renewable energy sector for over 10 years, and would have witnessed and participated in the selection process within the organization.

Another limitation is that due to sample space being too small; it is inconclusive that these factors could the most important factors to influence decision makers when selecting strategic projects for their organization.

3.6 Chapter Summary

The research methodology used for this research was described in this chapter. The onion ring was used to help in arriving at the approach used. A modified Delphi research approach was selected incorporating detail interviews with nine leading industry practitioners followed by thematic (qualitative) analysis to identify contributing factors. A survey questionnaire was then developed to permit further analysis and extraction of findings. The same nine participants would complete the survey questionnaire.

CHAPTER 4: RESULTS

4.1 Introduction

The previous chapter outlined the methodology used in this research. This chapter focuses on data collection and analysis of results.

4.2 Modified Delphi Technique.

Round 1 Survey

The first round primarily involved interviewing nine energy experts to examine their experiences in project portfolio selection and decision making, getting their views on what may represent best practice in the sector; and what they consider to be the major contributors to effective project selection and decision making. To address the research questions identified through the literature review, guiding questions were developed. The nine participants were selected based upon their experience, availability, recognition in their fields. The number of experts to be used in a Delphi technique is not definitive, Skulmoski et al (2007) suggests that the number depends on the group selected whether its homogeneous or heterogeneous. For a homogeneous group, nine experts would suffice especially where there are few experts on the subject matter. For a heterogeneous group, the numbers would be higher. An analysis on the comments from the interview with the experts was made to determine the factors influencing decision making in the selection of projects.

Round 1 research design

Interview questions designed to address the research questions were developed. These were guiding questions, suitable for the participants from very different backgrounds and multiple sector involvement. The discussion had to be flexible and adaptable, at the same time addressing the research questions, and getting their views on the important factors that contribute to or have a negative impact on effective investment decision making.

One interview was taken at the participants work place in a quiet conducive environment to minimize interruption while the rest of the interviews where done via phone. Throughout all this process notes were taken for valuable information extraction.

Round 2 – Questionnaire

A questionnaire was administered to the participants from the first round to rate the proposed factors and identify some of the tolls used in decision making. The responses were then collated for analysis.

Round 2 research design

A questionnaire was designed to obtain participant profile information as well as their ratings on the importance of each of the contributing factors identified in the first round.

4.3 Findings of Round 1 Relating to Best Practices.

During the interview, all the participants were asked the same questions on what they considered to be the best practices when it comes to selecting projects in the renewable energy sector. They all gave their response based on the industry they worked in. Those who worked in the private sector for long time related to following some guidelines and using financial tools at some stage of selection. The most common financial tools were the payback period method, internal rate of return. Other experts related that involving all stakeholders in the process was usually the best practice in their line of work. They felt that it was important for the government, private investors and the local people to be consulted on the type of project that would be best for the communities they were intended for. Alignment with organization vision, compliance with evaluation criteria in place, risks (environmental, political, financial-credit risk forex), Feasibility studies to determine the type of project, were also considered to be integral to this process. In this sector, it can be seen that the use of both financial and non-financial tools is employed.

4.4 Findings of Round 2 from The Questionnaire

Data for the set of factors identified in chapter 2 was collected and analyzed in Excel Microsoft software.

To get the overview of the factors at global level, the mean, variance and standard deviation for each factor was examined as presented below in Tables 4.1, 4.2 4.3 and Figure 4.1

Table 4.1 Factors influencing project selection by participants

ID	Factor	P1	P2	P3	P4	P5	P6	P7	P8	P9
1	Balance between business units served									
2	Risk profile of portfolio	•	•						•	
3	Renewable energy/technical risk	•	•		•	•	•	•	•	
4	Value add/Net Present Value/Internal Rate of Return		•				•		•	
5	Available budget		•	•	•		•	•		•
6	Renewable Energy Project Cost	•	•	•	•	•	•	•		•
7	Time frame for Renewable Energy Implementation			•		•			•	
8	Payback period		•	•	•		•			
9	Synergy effects between projects	•	•				•			
10	Personnel resources/capabilities	•	•							
11	Social, political and environmental issues	•	•			•	•	•	•	•
12	Job creation/wealth creation						•			
13	Strategic alignment/Leverage						•		•	
14	Intellectual property issues									

From a global perspective, of the factors listed in table 4.1, cost and risk are among the crucial factors to consider when selecting projects. This comes as no surprise considering that most of the renewable energy projects will involve huge capital investment and most investors will want to weigh the cost of setting up such investment and the associated risk against when they will reap back their money.

The Likert Scale was used to rate the participants scores where 5 = 'very important', 4 = 'quite important', 3 = 'neutral', 2 = 'not very important' and 1 = 'not important at all'. The scores where entered in the table 4.2 and the data was analyzed by considering the mean rate importance, variance, standard deviation and coefficient of variation. Participants are initialed by the letter P from participant number 1, P1 to participant number 9, P9.

Table 4.2 Factor rated by each participant

ID	Factor	P1	P2	P3	P4	P5	P6	P7	P8	P 9
1	Balance between business units served	4	3	2	3	2	3	4	3	2
2	Risk profile of portfolio	4	5	5	3	4	4	3	4	2
3	Renewable energy/technical risk	5	5	5	4	5	5	4	4	2
4	Value add/Net Present Value/Internal Rate of Return	4	5	4	4	4	5	5	5	2
5	Available budget	4	5	4	5	5	5	5	4	5
6	Renewable Energy Project Cost	4	5	5	5	5	5	5	4	2
7	Time frame for Renewable Energy Implementation	3	5	5	5	4	3	3	5	2
8	Payback period	3	4	5	5	5	4	4	3	2
9	Synergy effects between projects	4	5	4	3	3	5	4	3	2
10	Personnel resources/capabilities	5	5	4	3	3	2	4	4	2
11	Social, political and environmental issues	5	5	5	3	5	5	4	5	2
12	Job creation/wealth creation	3	3	5	3	4	4	3	4	2
13	Strategic alignment/Leverage	4	5	4	3	3	4	3	3	2
14	Intellectual property issues	3	3	3	3	2	1	3	2	2
15	Culture	4	2	5	2	1	1	3	2	4
16	Process	3	4	4	3	3	4	5	4	5
17	Knowledge of the business	4	5	5	5	5	3	3	4	2
18	Knowledge of the work	5	5	4	5	5	4	5	4	5
19	Education	3	4	5	4	4	4	5	4	5
20	Experience	5	4	5	5	5	4	5	5	5
21	Risk awareness	4	5	5	5	5	5	4	5	2
22	Governance	5	5	5	4	5	5	4	4	5
23	Selection of players	4	5	4	4	5	5	4	5	5
24	Preconceptions	4	4	4	3	2	3	3	3	5
25	Time pressures	3	5	4	3	4	2	3	3	2

Table 4.2 shows how the factors were scored by the nine participants on the Likert scale of 1(least Important) to 5(most Important). From these scores the mean was then calculated and the results tabulated in table 4.3. The mean is a measure of central tendency and its indicative of how far each score is to the central value. Also computed where the variance standard deviation and the coefficient of variation.

When rated and ranked in importance on the Likert scale, overall, fifteen factors have been identified as being important, their mean-rated importance as computed in table 4.3 is above 4.0. These factors are : (1) Risk profile of portfolio, (2) Renewable energy/technical risk, (3) Value add/Net Present Value/Internal Rate of Return, (4) Available budget, (5) Renewable Energy Project Cost, (6) Time frame for Renewable Energy Implementation, (7) Payback period, (8)

Social/political and environmental issues, (9) Knowledge of the business, (10) Knowledge of the work, (11) Education, (12) Experience, (13) Risk awareness, (14) Governance and (15) Selection of players.

From Table 4.3 showing the Mean rate importance, standard deviation, variance of factors and Coefficient of variation, the least significant factors are Intellectual property issues and Culture with mean of 2.50. It can be observed from the results that the participants were not in agreement on whether culture has a significant a role in the selection of renewable energy project, a variance above 1.0 is indicative of the different views the participants had on this factor, this is also seen in the coefficient of variation value being over 50percent. It can be observed from the results that where the factors are most important, and responses are the similar, the standard deviation and coefficient of variation are lowest indicating consistence in opinion and verification of identified factors.

Table 4.3 Mean rate Importance of factors overall

ID	Factor	Mean rate Importance	Standard Deviation	Variance	coefficient of variation
1	Renewable Energy Project Cost	4.75	0.43	0.19	9.12%
2	Experience	4.75	0.43	0.19	9.12%
3	Risk awareness	4.75	0.43	0.19	9.12%
4	Renewable energy/technical risk	4.63	0.48	0.23	10.47%
5	Available budget	4.63	0.48	0.23	10.47%
6	Social, political and environmental issues	4.63	0.70	0.48	15.05%
7	Knowledge of the work	4.63	0.48	0.23	10.47%
8	Governance	4.63	0.48	0.23	10.47%
9	Value add/Net Present Value/Internal Rate of Return	4.50	0.50	0.25	11.11%
10	Selection of players	4.50	0.50	0.25	11.11%
11	Knowledge of the business	4.25	0.83	0.69	19.51%
12	Time frame for Renewable Energy Implementation	4.13	0.93	0.86	22.47%
13	Payback period	4.13	0.78	0.61	18.92%
14	Education	4.13	0.60	0.36	14.53%
15	Risk profile of portfolio	4.00	0.71	0.50	17.68%
16	Synergy effects between projects	3.88	0.78	0.61	20.15%
17	Personnel resources/capabilities	3.75	0.97	0.94	25.82%
18	Process	3.75	0.66	0.44	17.64%
19	Job creation/wealth creation	3.63	0.70	0.48	19.20%
20	Strategic alignment/Leverage	3.63	0.70	0.48	19.20%
21	Time pressures	3.38	0.86	0.73	25.39%
22	Preconceptions	3.25	0.66	0.44	20.35%
23	Balance between business units served	3.00	0.71	0.50	23.57%
24	Intellectual property issues	2.50	0.71	0.50	28.28%
25	Culture	2.50	1.32	1.75	52.92%

Figure 4.1 indicates the Mean, Standard Deviation and Variance of the Factors at a global level and shows their behavior when plotted against each other. As expected the variance and standard deviation trends are showing the similarities of dependence on each other. The behavior described above about how the variance and mean vary with each other can now be clearly seen from the plot.

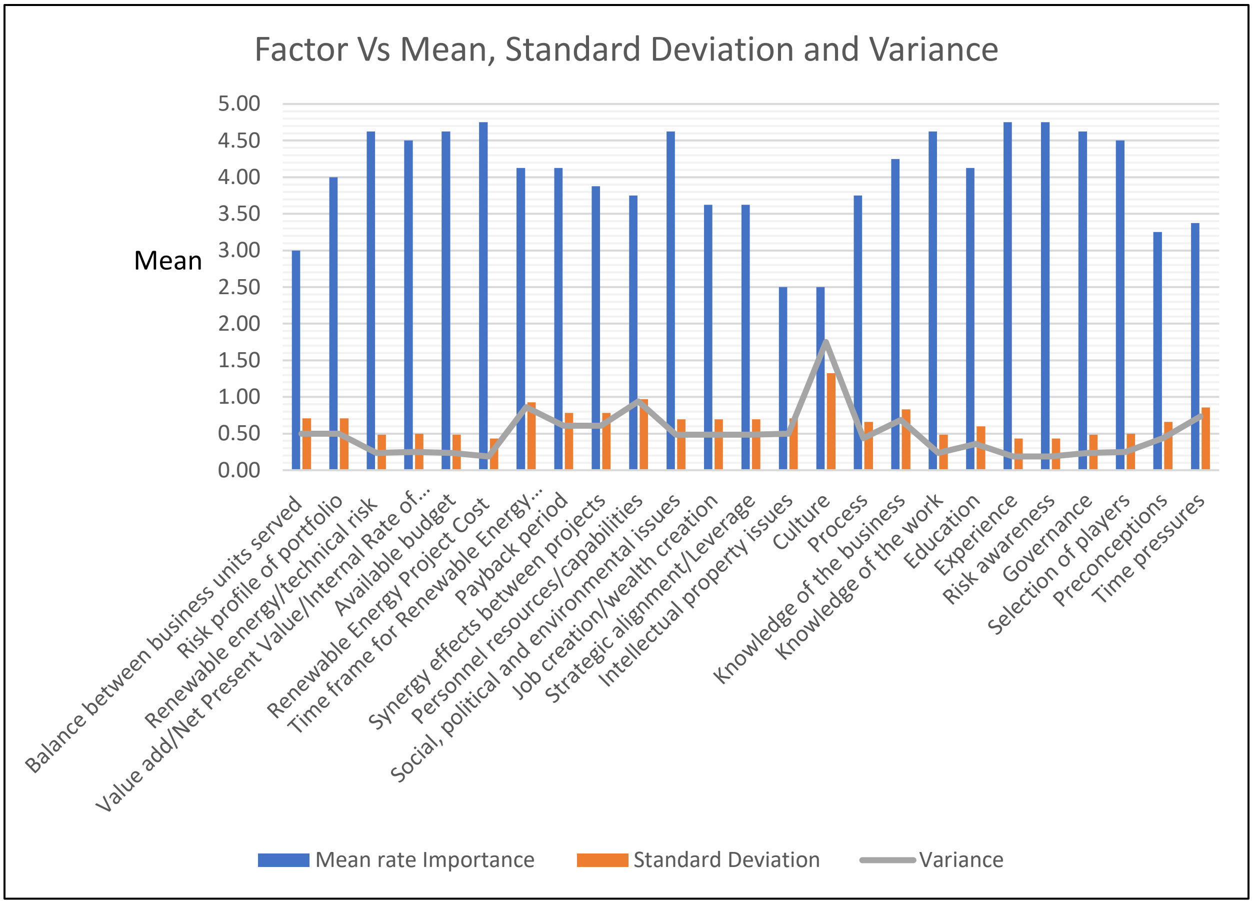

Figure 4. 1 Trend of Mean, Standard Deviation and Variance of the Factors Overall.

Evidently, factors with low mean rate importance have higher standard deviation and those with higher means have low standard deviation. A good example is Culture, the trends indicate this factor to be having low mean, its variance and standard deviation are high, similarly when you look at renewable energy cost, its mean rated importance is high and its standard deviation and variance are low.

When the results are examined sector-wise, it is interesting to see the same consistence for the factors that matter the most, their mean importance is high while their standard deviation is lower. From the analysis in Tables 4.4 and 4.5, the following factors are important across all sectors (1) Available budget, (2) Knowledge of the work, (3) Experience, (4) Governance, (5) Selection of players because their mean rated importance is greater than 4.0.

Table 4.4 Mean Rate Importance of Factors by Sector

ID	Factor	Private(P2, P3,P4,P8)	Public(P1,P5,P6)	Government Owned Corporation (P7,P9)
1	Balance between business units served	2.75	3.00	3.00
2	Risk profile of portfolio	4.25	4.00	2.50
3	Renewable energy/technical risk	4.50	5.00	3.00
4	Value add/Net Present Value/Internal Rate of Return	4.50	4.33	3.50
5	Available budget	4.50	4.67	5.00
6	Renewable Energy Project Cost	4.75	4.67	3.50
7	Time frame for Renewable Energy Implementation	5.00	3.33	2.50
8	Payback period	4.25	4.00	3.00
9	Synergy effects between projects	3.75	4.00	3.00
10	Personnel resources/capabilities	4.00	3.33	3.00
11	Social, political and environmental issues	4.50	5.00	3.00
12	Job creation/wealth creation	3.75	3.67	2.50
13	Strategic alignment/Leverage	3.75	3.67	2.50
14	Intellectual property issues	2.75	2.00	2.50
15	Culture	2.75	2.00	3.50
16	Process	3.75	3.33	5.00
17	Knowledge of the business	4.75	4.00	2.50
18	Knowledge of the work	4.50	4.67	5.00
19	Education	4.25	3.67	5.00
20	Experience	4.75	4.67	5.00
21	Risk awareness	5.00	4.67	3.00
22	Governance	4.50	5.00	4.50
23	Selection of players	4.50	4.67	4.50
24	Preconceptions	3.50	3.00	4.00
25	Time pressures	3.75	3.00	2.50

Table 4.4 shows the mean rate importance of the identified factor sector-wise. Factors with mean rate equal to or greater than 4 are considered to the crucial factors considered in the sector when selecting projects. There is a similarity in trends of these crucial factors in the private and public sector showing similar pattern on considering factors that influence the selection of projects

Table 4.5 Standard Deviation of factors by Sector

ID	Factor	Private(P2,P3,P4,P8)	Public(P1,P5,P6	Government Owned Corporation(P7,P9)
1	Balance between business units served	0.43	0.82	1.00
2	Risk profile of portfolio	0.83	0.00	0.50
3	Renewable energy/technical risk	0.50	0.00	1.00
4	Value add/Net Present Value/Internal Rate of Return	0.50	0.47	1.50
5	Available budget	0.50	0.47	0.00
6	Renewable Energy Project Cost	0.43	0.47	1.50
7	Time frame for Renewable Energy Implementation	0.00	0.47	0.50
8	Payback period	0.83	0.82	1.00
9	Synergy effects between projects	0.83	0.82	1.00
10	Personnel resources/capabilities	0.71	1.25	1.00
11	Social, political and environmental issues	0.87	0.00	1.00
12	Job creation/wealth creation	0.83	0.47	0.50
13	Strategic alignment/Leverage	0.83	0.47	0.50
14	Intellectual property issues	0.43	0.82	0.50
15	Culture	1.30	1.41	0.50
16	Process	0.43	0.47	0.00
17	Knowledge of the business	0.43	0.82	0.50
18	Knowledge of the work	0.50	0.47	0.00
19	Education	0.43	0.47	0.00
20	Experience	0.43	0.47	0.00
21	Risk awareness	0.00	0.47	1.00
22	Governance	0.50	0.00	0.50
23	Selection of players	0.50	0.47	0.50
24	Preconceptions	0.50	0.82	1.00
25	Time pressures	0.83	0.82	0.50

Table 4.6 Coefficient of Variation of factors by Sector

ID	Factor	Private(P2,P3 ,P4,P8)	Public(P1, P5,P6	Government Owned Corporation(P7,P9)
1	Balance between business units served	15.75%	27.22%	33.33%
2	Risk profile of portfolio	19.51%	0.00%	20.00%
3	Renewable energy/technical risk	11.11%	0.00%	33.33%
4	Value add/Net Present Value/Internal Rate of Return	11.11%	10.88%	42.86%
5	Available budget	11.11%	10.10%	0.00%
6	Renewable Energy Project Cost	9.12%	10.10%	42.86%
7	Time frame for Renewable Energy Implementation	0.00%	14.14%	20.00%
8	Payback period	19.51%	20.41%	33.33%
9	Synergy effects between projects	22.11%	20.41%	33.33%
10	Personnel resources/capabilities	17.68%	37.42%	33.33%
11	Social, political and environmental issues	19.25%	0.00%	33.33%
12	Job creation/wealth creation	22.11%	12.86%	20.00%
13	Strategic alignment/Leverage	22.11%	12.86%	20.00%
14	Intellectual property issues	15.75%	40.82%	20.00%
15	Culture	47.24%	70.71%	14.29%
16	Process	11.55%	14.14%	0.00%
17	Knowledge of the business	9.12%	20.41%	20.00%
18	Knowledge of the work	11.11%	10.10%	0.00%
19	Education	10.19%	12.86%	0.00%
20	Experience	9.12%	10.10%	0.00%
21	Risk awareness	0.00%	10.10%	33.33%
22	Governance	11.11%	0.00%	11.11%
23	Selection of players	11.11%	10.10%	11.11%
24	Preconceptions	14.29%	27.22%	25.00%
25	Time pressures	22.11%	27.22%	20.00%

Within the sector, it can be seen that for factors that matter the most, there is more consistence in the results than across the sectors which is indicated by high mean and low standard deviation. For example, in the private sector the participants strongly agreed that Time frame for Renewable Energy Implementation and Risk awareness are critical to the selection projects. In the public sector, it is Risk profile of portfolio, Renewable energy/technical risk, Social/Political and environmental issues Governance where the participants seem to be on the same page. In the Government Owned institution the participants are on the same page for these factors, namely: Available budget, Process, Knowledge of the work, Education, Experience. This is expected as the interests of the sectors differ. Interestingly the two least crucial factors Intellectual property issues and Culture are still considered least even when the results are narrowed down to sector level showing consistence with overall results. Experience is rated higher than Education in all the sectors but more so in the Government sector.

To gain insight into how these experts selected the factors, the mean rate importance was examined by years of experience. This criterion helped to see if experience had a significant role in the decision-making process of the renewable energy sector of Zambia. Tables 4.7 and 4.8 present these results.

Table 4.7 mean rate Importance of factors by years of Experience

ID	FACTOR	< 5 YEARS(P5,P7)	>= 5 < 10 YEARS(P9, P2)	>= 10 < 15 YEARS(P3,P4, P8)	>= 15 YEARS(P1,P6)
1	Balance between business units served	3.00	2.50	2.67	3.50
2	Risk profile of portfolio	3.50	3.50	4.00	4.00
3	Renewable energy/technical risk	4.50	3.50	4.33	5.00
4	Value add/Net Present Value/Internal Rate of Return	4.50	3.50	4.33	4.50
5	Available budget	5.00	5.00	4.33	4.50
6	Renewable Energy Project Cost	5.00	3.50	4.67	4.50
7	Time frame for Renewable Energy Implementation	3.50	3.50	5.00	3.00
8	Payback period	4.50	3.00	4.33	3.50
9	Synergy effects between projects	3.50	3.50	3.33	4.50
10	Personnel resources/capabilities	3.50	3.50	3.67	3.50
11	Social, political and environmental issues	4.50	3.50	4.33	5.00
12	Job creation/wealth creation	3.50	2.50	4.00	3.50
13	Strategic alignment/Leverage	3.00	3.50	3.33	4.00
14	Intellectual property issues	2.50	2.50	2.67	2.00
15	Culture	2.00	3.00	3.00	2.50
16	Process	4.00	4.50	3.67	3.50
17	Knowledge of the business	4.00	3.50	4.67	3.50
18	Knowledge of the work	5.00	5.00	4.33	4.50
19	Education	4.50	4.50	4.33	3.50
20	Experience	5.00	4.50	5.00	4.50
21	Risk awareness	4.50	3.50	5.00	4.50
22	Governance	4.50	5.00	4.33	5.00
23	Selection of players	4.50	5.00	4.33	4.50
24	Preconceptions	2.50	4.50	3.33	3.50
25	Time pressures	3.50	3.50	3.33	2.50

Table 4.8 Standard deviation of factors by years of Experience

ID	FACTOR	< 5 YEARS(P5,P7)	>= 5 < 10 YEARS(P9,P2)	>= 10 < 15 YEARS(P3,P 4,P8)	>= 15 YEARS(P1 ,P6)
1	Balance between business units served	1.00	0.50	0.47	0.50
2	Risk profile of portfolio	0.50	1.50	0.82	0.00
3	Renewable energy/technical risk	0.50	1.50	0.47	0.00
4	Value add/Net Present Value/Internal Rate of Return	0.50	1.50	0.47	0.50
5	Available budget	0.00	0.00	0.47	0.50
6	Renewable Energy Project Cost	0.00	1.50	0.47	0.50
7	Time frame for Renewable Energy Implementation	0.50	1.50	0.00	0.00
8	Payback period	0.50	1.00	0.94	0.50
9	Synergy effects between projects	0.50	1.50	0.47	0.50
10	Personnel resources/capabilities	0.50	1.50	0.47	1.50
11	Social, political and environmental issues	0.50	1.50	0.94	0.00
12	Job creation/wealth creation	0.50	0.50	0.82	0.50
13	Strategic alignment/Leverage	0.00	1.50	0.47	0.00
14	Intellectual property issues	0.50	0.50	0.47	1.00
15	Culture	1.00	1.00	1.41	1.50
16	Process	1.00	0.50	0.47	0.50
17	Knowledge of the business	1.00	1.50	0.47	0.50
18	Knowledge of the work	0.00	0.00	0.47	0.50
19	Education	0.50	0.50	0.47	0.50
20	Experience	0.00	0.50	0.00	0.50
21	Risk awareness	0.50	1.50	0.00	0.50
22	Governance	0.50	0.00	0.47	0.00
23	Selection of players	0.50	0.00	0.47	0.50
24	Preconceptions	0.50	0.50	0.47	0.50
25	Time pressures	0.50	1.50	0.47	0.50

When examined by years of experience in the industry, the results reveal a pattern that within the same years of experience there is a strong agreement on how factors influence the selection of project (Table 4.7 and 4.8). It is interesting to note that as years of experience increase the factors seem to be similar. This explains perhaps why participants with more than 15 years of experience feel that education is less important than experience when it comes to selecting who will be part of the team on the project but those below five years feel that education is crucial. These participants are more risk averse compared to those with less than 5 years of experience who are more focused on financial factors.

The small sample size in this study has an effect on the relationship of the factors as no strong inference can be drawn between them. However, there is consistence with the findings from the interviews conducted with the participants as they discussed their experiences and observations across the sectors. Risk awareness is rated higher across all the sectors due to proneness of more risk associated with renewable energy; governance is rated higher in the public sector because accountability and transparence demanded by the public, political and media.

4.4 Chapter Summary

The chapter presented the results from the interview with the selected participants who shared the current practice of selecting projects in the renewable energy sector. No consistence has been found on the use of selection methods for projects in the renewable energy sector. Different approaches have been used based on the ease of use, simplicity, and flexibility mostly. It also analyzed the results from the answered questionnaire which was designed to address the research question on the factors that influence decision making in the sector of renewable energy. Fifteen factors have been identified as the important factors that influence the choice of projects selected in the industry. The identified factors are : (1) Risk profile of portfolio; (2) Renewable energy/technical risk; (3) Value add/Net Present Value/Internal Rate of Return; (4) Available budget; (5) Renewable Energy Project Cost; (6) Time frame for Renewable Energy Implementation; (7) Payback period; (8) Social/political and environmental issues; (9) Knowledge of the business; (10) Knowledge of the work; (11) Education; (12) Experience; (13) Risk awareness; (14) Governance and (15) Selection of players.

The players in the renewable energy sector consider Risk Awareness, Experience and cost of renewable energy to be the top 3 critical factors influencing decision makers and overall across all the sectors, Culture of the organization is considered to be the least factor that can influence the selection of projects. The results are discussed in chapter 5 in light of the literature from chapter 2.

CHAPTER 5: DISCUSSION

5.1 Introduction

The previous chapter presented results obtained from the interviews and questionnaire in this research and provided analysis of the data. This chapter discusses these results in relation to the literature reviewed in chapter 2. The first section of the discussion focuses on the best practices in the selection of projects and validates the response of current practices in the energy sector in Zambia. The second part continues the discussion of the contributing factor in line with reviewed literature. In addition, the importance of project selection with regards to strategic decision making is highlighted.

5.2 Best Practice of Project Selection in Renewable Energy Sector

From the interviews, the researcher was able to gain insight into the current practice in the renewable energy sector on how projects are selected. The interviews revealed that project selection criteria, tools and techniques in the sector are not uniform. In fact there is no standard way in which projects are selected across the sectors. In the private sector, the participants choose the approach of conducting feasibility studies to determine the type of project, involve stake holders (Government / Private partners) alike, examine the technical/finance environmental and social impact, look at project sustainability as well as use basic financial decision-making tools such as payback period (PBP), internal rate of return and check lists. The participants in the public and government owned institutions where largely guided by the energy master plan. Basically, the government employed consultants to do all the preliminary works and recommend to government which projects would be profitable or were worth to carry out, and then they would implement such. Most of these experts would not be part of the decision-making team but the implementation team. These revelations are consistent with literature where Åstebro (2004) stated that no single optimal method exists for selecting projects even in the same sector. The participants recognized that organization culture influenced the methods used for selecting projects. They were also cognizant of the fact that there are other tools and techniques which they may not have been so conversant with that existed and could be used in the selection of projects. Depending on the experience of each participants and what organisations they worked under, the adopted tools where largely dependent on what was comfortable for the organization to use. There where similarities as well as variations on the adopted tools and techniques.

5.3 Contributing Factors to Project Selection

Fifteen contributing factors were identified to be very important and influential in the selection of projects in the renewable energy division of Zambia. These were placed in four categories namely:
(1) Players, leadership, and tacit knowledge; (2) risk factors; (3) governance; (4) timing and cost. The categories of factors where then analyzed across the three sectors: private, public and Government owned institutions. The rest of the factors were rated higher in the same sector but not across all the three sectors.

5.3.1 Players and Tacit Knowledge

Under this category are the following factors: (1) knowledge of the business; (2) knowledge of the work; (3) education; (4) experience; (5) selection of players.

Knowledge of the business usually goes hand in hand with skills. It is the ability to apply business principles, including systems thinking to the work environment(Garman, 2006). Business knowledge competencies would include: project management, organizational business and personal ethics, facilities planning, purchasing procurement, evidence-based practice, inventory control systems, proposal analysis and contract negotiation, critical thinking, and analysis, needs analysis for and/or desirability of outsourcing, and outcomes management implementation. Possessing business knowledge gave one a competitive edge over his peers and is desirable to decision making. Knowledge of work is defined as job, process, or task that is distinguished by its specific information content or requirements (Vijay, 2009). It is specific and technical knowledge usually associated with explicit knowledge, and provides crucial input into the decision-making process.

Project selecting committee consisting of key players is fundamental to ensuring a quality process of project selection is established. Every organization must choose decision makers, executives and other key players who have the desired qualification, experience, expertise and intuition and personal qualities for leadership and collaboration. Whilst recognizing the importance of education, the participants rated it lower than work experience. Work experience reveals certain aspects of an individual’s character such as how one behaves when working in a team, how one deals with real life situation, resolving problems, which could be crucial when it comes to making decision. These qualities are rarely revealed by education but revealed in reality through experience which makes it more desirable.

When discussing strategic leadership, Arikan and Enginoğlu pointed out that it involved top management's characteristics, their way of doing things and the way they affect their organization's performance (Arikan, C., Enginoğlu, D 2016). "The boards, executives, and top management teams naturally play significant roles in determining the strategic direction and how the strategy gets translated into everyday execution". This suggests that players in the project selection and strategic decision-making positions need to be carefully selected and they need to apply their tacit knowledge in their decision making.

5.3.2 Risk Factors.

Under this category are the following factors (1) risk profile of portfolio; (2) renewable energy/technical risk; (3) risk awareness; (4)social/political and environmental issues

The accumulation of a variety of significant investment risks makes the financing of renewable energy investments difficult in a developing country context. The general risk associated with the unfamiliarity of renewable energy technologies is particularly pronounced in developing countries that have never used these technologies before, overall business infrastructure and expert ability in these advancements. This risk is amplified by such investment risks that are typical for developing countries such as: political risk, currency, impact on the environment and commercial risk induced by the poor creditworthiness of state owned utilities that carry the payment obligations to buy generated power under power purchase agreements. The accumulation of these factors worsens the risk profile of investment, and the return expectations of potential developers and their financial backers reach alarming levels. For potential investors, risk profile and risk awareness is crucial in decision making. While the consideration of risk for each candidate project is crucial, at the strategic level the risk awareness of the organization when it comes to aligning strategic objective is desired. The awareness and application of enterprise wide approaches to risk management is certainly crucial to the identification and realization of business opportunities and benefits.

From the interviews and the questionnaire, the participants rated financial and weather-related risk to be the highest in terms of ranking. They related that most of the renewable energy projects require with high capital expenditures but there is a challenge in access to capital for them to be viable. Additionally, capital markets in Zambia are not as mature as in developed countries, making it difficult to get private financing. Another challenge related to this risk was the high interest rates of borrowing capital for such investments, which can explain the poorly developed bond markets. Additionally, concern raised was the fact that the average cost of electricity generation in general is exceptionally high, due to the small size of electricity markets and the resulting lack of economies of scale. This means that the return rates will be very slow and as such does not encourage private sector participation which is driven by profits.

5.3.3 Governance

Good governance is concerned with the processes for making and implementing decisions that are consistent with relevant legislation. Governance drives accountability and process, and supports a collective approach to achieving best outcomes. The business dictionary defines governance as the, "Establishment of policies, and continuous monitoring of their proper implementation, by the members of the governing body of an organization," (Vijay, 2009). It further explains that included within it are the mechanisms required to balance the powers of the members (with the associated accountability) and their primary duty of enhancing the prosperity and viability of the organization. From this definition, a clear relationship between the selection of places and governance can be seen as the members who preside at governance are the carefully selected decision makers who have apply both explicit knowledge and tacit knowledge and their experience. This resonated well with the participants hence they ranked governance high on the Likert scale. They further characterized good governance as being accountable, transparent, following the rule of law, responsive, equitable and inclusive, effective and efficient and participatory.

5.3.4 Timing and Cost

Under this category are the following factors: (1) available budget; (2) renewable energy project cost; (3) time frame for renewable energy implementation and; (4) payback period.

These factors are rated high across the sectors because of the financial and timing aspect associated with them. Available budgets and cost of renewable energy projects will normally dictate what type of project to engage in. These factors will have a strong bearing on the type of project selected.

These two factors form part of what is commonly referred to as the Triple Constraint or the Iron Triangle in project management. Change in timing factor naturally impacts on the cost and quality. Recognizing the two as factors that matter on selection of projects reveals that the participants recognize project management principles in the decision making.

5.4 Tools

The results reveal that 67% of participants have used formal tools to select projects; 11% of the participants do not use or know of formal tools used in the selection of projects and 22% are not sure whether the formal tools are used or not. Decision tools can improve the quality of projects selected and change the outlook of the organization to reposition itself and remain or become competitive in the industry. The survey also revealed that the most common decision tools employed are the financial models because they are easy to use and they are flexible. Other tools are either unknown to the decision makers or just do not apply in their processes. While financial models are desired, they have limitations and can lead to incorrect choice of projects which are prone to high risk. This revelation has impact on the type of projects selected on to the portfolio. If models such as Business Strategy Models and Bubble Diagrams are employed they could greatly improve the quality of projects selected on the portfolios as they not only look at the risk but they look at the strategies for the organization

5.5 Chapter Summary

The chapter discussed the 15 contributing factors and their criticality when it comes to selection of project. The factors where further consolidated into only four categories namely: (1) Players, leadership, and tacit knowledge; (2) risk factors; (3) governance; (4) timing and cost factors. These factors were then viewed from two angles; how the participants looked at them and how literature highlights them. The other issue discussed was the use of tools in project selection and how they can improve the process of project selection. The following chapter presents the conclusions and recommendations of the study.

CHAPTER 6: CONCLUSIONS AND RECOMMENDATIONS

The previous chapter discussed the factors influencing selection of project. This chapter outlines the conclusions, limitations and recommendations of the study.

6.1 Conclusions

This research was conducted to (1) identify critical factors in the selection of renewable energy projects in the energy sector of Zambia; (2) Establish why these factors are significant ; and (3) determine the universality of these factors across the sector in Zambia. the following conclusions can be made with regards to the case of selecting projects in the renewable energy sector of Zambia:

6.1.1 factors that influence project selection

Fifteen contributing factors were identified to be very important and influential in the selection of projects the renewable energy division of Zambia:(1) Risk profile of portfolio; (2) Renewable energy/technical risk; (3) Value add/Net Present Value/Internal Rate of Return; (4) Available budget; (5) Renewable Energy Project Cost; (6) Time frame for Renewable Energy Implementation; (7) Payback period; (8) Social/political and environmental issues; (9) Knowledge of the business; (10) Knowledge of the work; (11) Education; (12) Experience; (13) Risk awareness; (14) Governance and (15) Selection of players.

6.1.2 why these factors are significant

Investment managers of these firms or organisations have a challenging job of deciding the type investment to pursue for their firms using the available resources. This process of selecting which opportunity to pursue is never a straight forward one because strategic goals and objectives of organisations and institutions are the drivers of project selection. Managers have to select viable projects and develop guidelines for balancing the opportunities and costs associated with each alternative. They must strive to maintain a balance between the competing demands of time and opportunity. Decision makers must exercise caution and make the best choice among their options. Organisations can develop selection models that permit them to optimize time and money, minimize losses while maximizing the likelihood of success.

6.1.3 universality of these factors across the sector in Zambia

There is no single recognized best practice in the selection of projects in this sector. The choice of projects selected depends on the cultural values embraced by each organization. The practice differs within the sectors and across the sector. There is no consistency between the current practice and what is prescribed in literature, a gap exists.

6.2 Recommendations

Existing Framework for project selection

The participants did not outline any existing framework for selecting projects under this sector. In order to come up with any framework structure for project selection, the next study should use these identified factors and put them to test empirically. A triangulation of methodologies including a literature analysis, focus group, Delphi study and case study can be used to achieve this. Having a framework in place will certainly help in meeting the economic challenge facing the country and help to electrify most of the rural areas at the same time create employment.

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APPENDICES

Appendix 1: **Research Questionnaire**

Please tick in the space provided

Section A: General

1. What is your Gender?
   - ☐ M
   - ☐ F
2. What is your age Profile?
   - ☐ Below 18 Years
   - ☐ Between 18 and 25 Years
   - ☐ Between 25 and 50 Years
   - ☐ Above 50 Years
3. What is the current industry sector you work in?
   - ☐ Private
   - ☐ Public
   - ☐ Government Owned Corporation
   - ☐ Other, please state……………………………………
4. In which industry sector have you worked the most?
   - ☐ Private
   - ☐ Public
   - ☐ Government Owned Corporation
5. **What is your position in your organization?**
   - ☐ Senior Management
   - ☐ Middle Management
   - ☐ Junior Management

☐ Unionized employee

☐ Other, please state………………………………………………….

6. What is your highest level of education?

☐ Doctorate

☐ Master's degree

☐ Bachelor's degree

☐ Diploma

☐ Other, please state……………………………………………

7. What are your years of experience in the Energy Industry?

☐ Under 5 Years

☐ Between 5 and 10 Years

☐ Between 10 and 15 Years

☐ Between 15 and 20 Years

☐ Between 20 and 25 Years

☐ Above 25 Years

8. What form of energy does your institution deal in?

☐ Wood fuel (Charcoal and firewood)

☐ Hydro Power

☐ Nuclear Power

☐ Solar Power

☐ Biofuel

☐ Wind Power

☐ Petroleum

☐ Other ....Please specify

Section B: Renewable Energy

9. Thinking about the future of renewable energy industry, how significant do you expect growth in installed capacity to be in each of the following industry segments?

	Very high (25% or more)	High (15-25%)	Flat to moderate (0-15%)	No growth	Don't know
Solar energy (including PV and thermal)					
Wind power					
Bio-energy (eg, wood pellets, crops, waste, and their derivatives)					
Hydropower (including hydroelectricity and tidal energy)					
Geothermal energy					

10. Thinking about your company in particular, how significant do you expect growth in installed capacity to be in each of the following industry segments?

	Very high (25% or more)	High (15-25%)	Flat to moderate (0-15%)	No growth	Don’t know
Solar energy (including PV and thermal)					
Wind power					
Bio-energy (eg, wood pellets, crops, waste, and their derivatives)					
Hydropower (including hydroelectricity and tidal energy)					
Geothermal energy					

11. How significant is renewable energy to your company’s overall business strategy today, and how significant do you expect it to be in future?

	Highly significant	Moderately significant	Not at all significant	Don’t know/not applicable
Today:				
Future				

12. Please estimate the average year-on-year change in your company's total investment budget for renewable energy powerprojects in future. (Please choose one answer only).

- ☐ Very high (25% or more)
- ☐ High (15-25%)
- ☐ Flat to moderate (0-15%)
- ☐ No growth
- ☐ Negative Growth
- ☐ Don't know/ Not Applicable

13. What factors are taken into consideration when it comes to selection projects in Renewable Energy?

- ☐ Balance between business units served
- ☐ Risk profile of portfolio
- ☐ Renewable energy/technical risk
- ☐ Value add/Net Present Value/Internal Rate of Return
- ☐ Available budget
- ☐ Renewable Energy Project Cost
- ☐ Time frame for Renewable Energy Implementation
- ☐ Payback period
- ☐ Synergy effects between projects
- ☐ Personnel resources/capabilities
- ☐ Social, political and environmental issues
- ☐ Job creation/wealth creation
- ☐ Strategic alignment/Leverage
- ☐ Intellectual property issues
- ☐ All the Above

14. Based on your experience, how would you rate each of the following factors in terms ofImportance when it comes to selection of renewable energy projects in your sector?

Factor	Rating				
	Very Important	Quite Important	Neutral	Not Very Important	Not Important at All
Balance between business units served					
Risk profile of portfolio					
Renewable energy/technical risk					
Value add/Net Present Value/Internal Rate of Return					
Available budget					
Renewable Energy Project Cost					
Time frame for Renewable Energy Implementation					
Payback period					
Synergy effects between projects					
Personnel resources/capabilities					
Social, political and environmental issues					
Job creation/wealth creation					
Strategic alignment/Leverage					
Intellectual property issues					

15. To what extent do the following factors influence the selection of projects?

Factor	Rating				
	Very Important	Quite Important	Neutral	Not Very Important	Not Important at All
Culture					
Process					
Knowledge of the business					
Knowledge of the work					
Education					
Experience					
Risk awareness					
Governance					
Selection of players					
Preconceptions					
Time pressures					

16. Are there formal tools used to select Renewable Energy projects?

- ☐ Yes
- ☐ No
- ☐ Not Sure

17. If the answer to question 16 is yes, what tools are used by your organisation?

- ☐ Bubble diagrams
- ☐ Wheelwright matrix
- ☐ Checklist Model
- ☐ The Analytical Hierarchy Process
- ☐ Simplified scoring Models
- ☐ Profile Models
- ☐ Financial Models
- ☐ Others, Please state below

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18. What has influenced your organisation to adopt the chosen method and tools in Q16 and Q17?

- ☐ Realism (as is reasonable in light of such constraints on resources as money and personnel.)
- ☐ Cost
- ☐ Ease of use
- ☐ Capability
- ☐ Flexibility
- ☐ Comparability

19. At what stage are selection models applied?

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20. Who are the key personnel constituting the Portfolio selection team in Renewable energy Projects in your organisation?

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21. Which of the following criteria has been used to select key personnel for the Portfolio Management team?

- ☐ Relevant Experience in the field
- ☐ Relevant Education
- ☐ Age
- ☐ Position held in the organisation
- ☐ Influence in the organisation and political connections

22. What Project selection framework structure has been adopted in project selection within your organisation?

23. As a general matter, how would you assess the overall degree of risk associated with each of the following stages of building and operating a renewable energy power plant?

	High risk	Medium risk	Low risk	Don't know/ not applicable
Financing the plant				
Planning/designing the plant				
Building the plant				
Operating the plant				
Retrofitting the plant				
Decommissioning the plant				

24. How would you rate the significance of each of the following types of risk to your renewable energy projects?

	High risk	Medium risk	Low risk	Don’t know/ not applicable
Financial risk (eg, access to capital)				
Business/strategic risk (eg, technological obsolescence)				
Building and testing risks (eg unproven technology, natural hazards)				
Operational risk (eg, plant closure due to resource unavailability or plant damage/ component failure)				
Environmental risk (eg, liability for environmental damage)				
Political/regulatory risk (eg, change in public policy affecting profitability)				
Market risk (eg, increase in commodity prices or decrease in power prices)				
Weather-related volume risk (eg, lack of wind or sunshine)				
Other risk, please identify				

25. Are there any other factors that you believe are important in project decision making that should be included in this list, and why?

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....

Appendix 2 Results of **Research Questionnaire**

ID	P1	P2	P3	P4	P5	P6	P7	P8	P9
Q1	1	1	1	2	1	1	1	1	2
Q2	4	3	3	3	3	3	3	3	3
Q3	4	1	4	1	2	3	2	1	2
Q4	2	1	1	1	2	2	3	1	3
Q5	1	2	1	3	2	3	2	2	2
Q6	1	2	1	4	2	3	3	3	2
Q7	5	2	3	3	1	7	1	3	2
Q8	1,2,4,5,8	2,4,5,7	2,4	4	1,2,3,4,5,6,7,8	1,2,3,4,5,6,7,8	2,4,6	2,4,7	2,4,6
Solar energy (including PV and thermal)	4	4	5	4	5	5	4	4	3
Wind power	3	3	3	2	3	3	3		1
Bio-energy (eg, wood pellets, crops,	4	3	3	3	5	4	5	3	3

ID	P1	P2	P3	P4	P5	P6	P7	P8	P9
waste, and their derivatives)									
Hydropower (including hydroelectricity and tidal energy)	3	5	3	5	5	5	3	4	4
Geothermal energy	3	1	3	2	3	3	3	3	1
Solar energy (including PV and thermal)	4	3	2	4	5	5	4	3	4
Wind power	2	2	2	2	3	3	3		1
Bio-energy (eg, wood pellets, crops, waste, and their derivatives)	5	2	2	2	5	4	5	3	4

ID	P1	P2	P3	P4	P5	P6	P7	P8	P9
Hydropower (including hydroelectricity and tidal energy)	3	3	2	2	5	5	4	4	4
Geothermal energy	2	2	2	2	3	3	2	3	1
Today	3	4	4	3	4	3	4	3	3
Future	4	4	4	4	4	4	4	4	4
Q12	2	1	1	2	2	1	1	2	3
Q13	2,3,6,9,10,11	2,3,4,5,6,8,9,10,11	5,6,7,8	3,5,6,8	3,6,7,11	3,4,5,6,8,9,11,12,13	3,5,6,11	2,3,4,7,11,13	5,6,11
Balance between business units served	4	3		3	2	3	4	3	2
Risk profile of portfolio	4	5	5	3	4	4	3	4	2
Renewable energy/technical risk	5	5	5	4	5	5	4	4	2
Value add/Net Present	4	5	4	4	4	5	5	5	2

ID	P1	P2	P3	P4	P5	P6	P7	P8	P9
Value/Internal Rate of Return									
Available budget	4	5	4	5	5	5	5	4	5
Renewable Energy Project Cost	4	5	5	5	5	5	5	4	2
Time frame for Renewable Energy Implementation	3	5	5	5	4	3	3	5	2
Payback period	3	4	5	5	5	4	4	3	2
Synergy effects between projects	4	5	4		3	5	4	3	2
Personnel resources/capabilities	5	5	4	3	3	2	4	4	2

ID	P1	P2	P3	P4	P5	P6	P7	P8	P9
Social, political and environmental issues	5	5	5	3	5	5	4	5	2
Job creation/wealth creation	3	3	5	3	4	4	3	4	2
Strategic alignment/ Leverage	4	5	4	3	3	4	3	3	2
Intellectual property issues	3	3	3	3	2	1	3	2	2
Culture	4	2	5	2	1	1	3	2	4
Process	5	4	4	3	3	4	5	4	5
Knowledge of the business	4	5	5	5	5	3	3	4	2
Knowledge of the work	5	5		5	5	4	5	4	5
Education	3	4	5	4	4	4	5	4	5
Experience		4	5	5	5	4	5	5	5

ID	P1	P2	P3	P4	P5	P6	P7	P8	P9
Risk awareness	4	5	5	5	5	5	4	5	2
Governance	5	5	5	4	5	5	4	4	5
Selection of players	4	5	4	4	5	5	4	5	5
Preconceptions	4	4	4	3	2	3	3	3	5
Time pressures	3	5	4	3	4	2	3	3	2
Q16	1	1	3	2	1	1	3	1	1
Q17	4,7,8	5,7			3,7	6,7		3,5,7	
Q18	3,6	6			1,2,3	3,5,6		1,3,6	3
Q21	1,2	1,2,4	1,2	1,2,5	1,2,4	1,2,4	1,2	1,2,4	4
Financing the plant		4	3	4	3	4		4	4
Planning/designing the plant		4	3	4	3	2		3	4
Building the plant		4	3	4	3	4		3	3
Operating the plant		4	3	3	2	3		3	2

ID	P1	P2	P3	P4	P5	P6	P7	P8	P9
Retrofitting the plant		3	3	4	2	2	4	2	3
Decommissioning the plant		2	3	4	2	1	4	2	2
Financial risk (eg, access to capital)	4	4	3	4	3	4		4	4
Business/strategic risk (eg, technological obsolescence)	3	3	2	3	3	3		3	4
Building and testing risks (eg unproven technology, natural hazards)	3	3	2	3	3	4		3	4
Operational risk (eg, plant closure due	5	2	2	3	2	2		3	4

ID	P1	P2	P3	P4	P5	P6	P7	P8	P9
to resource unavailability or plant damage/ component failure)									
Environmental risk (eg, liability for environmental damage)	3	2	2	3	2	3		2	4
Political/regulatory risk (eg, change in public policy affecting profitability)	4	2	2	3	4	2		3	4
Market risk (eg, increase in commodity prices or decrease in	4	2	2	3	4	3		3	2

ID	P1	P2	P3	P4	P5	P6	P7	P8	P9
power prices)									
Weather-related volume risk (eg, lack of wind or sunshine)	4	4	3	4	4	4		3	4
Other risk, please identify	4	-'			4				

Appendix 3 Interview Expert Questions and responses

1 What industry and sector are you involved in?Some participants may be involved in more than one which may present different perspectives.

Climate- nutrition projects such as bee keeping
Water and sanitation
Renewable energy bio mass energy projects/bio-gas digesters

2 Are you involved in selection decisions for your organization or do you just provide advice as in the role of a consultant?
Involved in providing advice, building capacity for the community and construction of bio-digesters

3 What is your role and level of authoritywith respect to decisions?

Project manager- implementing project plans by executing the projects according to donor's direction

4 What do you regard asbest practice in project portfolio selection for your organisation? This could involve the use of tools and techniques. For some participants this mayfocus on critical decision making. Feasibility studies to determine the type of project,

Bring all stake holders involved(Govt/ Private partners) together
Supply/Demnad analysis
Examine the technical/finance environmental and social impact
Look at project sustenability

5 Do you believe that your organisation follows best practice?

Yes- private sector can play a major role in renewable energy sector provided the Govt provides an enabling environment.
Renewable energy concerpt not fully considered important impacted by lack of economies of scale. Investment so high with no guaranteed returns, interest rates from the banks are so prohibitively high. Govt not taking a leading role. Implementation of cost reflective tariffs. Investments in the sector has been significant but results not impressive, most investment is on capacity building rather than on actual projects. government need to be proactive, taking a leading role in coordinating the efforts from different stakeholders

5A If yes, what does the organisation do to
facilitate such practice, and what are the
threats to this?

5B If no, what are the inhibitors or barriers to
providing better practice? Alternatively, what could be done tofacilitate better practice? A supplementary question – of these inhibitors / contributors which do you think are most important?

1 What industry and sector are you involved in?Some participants may be involved in more than one which may present different perspectives.

Energy – hydro-electric, thermal energy, Geo thermal, bio mass. hot spring

2 Are you involved in selection decisions for your organization or do you just provide advice as in the role of a consultant?
-both

3 What is your role and level of authoritywith respect to decisions?
High level, senior manager

4 What do you regard asbest practice in project portfolio
selection for your organization? This could involve the use of tools and
techniques. Feasibility study done. Consultants engage feasibility study
tendering for projects

Not sure

5A If yes, what does the organization do to
facilitate such practice, and what are the

threats to this?

5B If no, what are the inhibitors or barriers to

providing better practice? Alternatively, what could be done tofacilitate better practice? A supplementary question – of these inhibitors / contributors which do you think are most important?

- No standards
- Cost on feasibility study- resource allocation.
- No guarantees from government.
- No political will.

  Government is beginning to lay foundation for would be investors

  Feeding tariff, waiver on energy generating products.

1 What industry and sector are you involved in?Some participants may be involved in more than one which may present different perspectives.

Energy – hydro-electric, thermal energy, Geo thermal, bio mass. hot spring

2 Are you involved in selection decisions for your organization or do you just provide advice as in the role of a consultant?

-both

3 What is your role and level of authoritywith respect to decisions?
High level, senior manager

4 What do you regard asbest practice in project portfolio selection for your organization? This could involve the use of tools and techniques. For some participants, this mayfocus on critical decision making. -Expansion, re-enforcement, new market penetration-type of projects -alignment organization vision
-compliance with evaluation criteria inplace- enviroment
-risk- political, financial-credit risk forex, Tools check list, PBP, IRR,-financial
5 Do you believe that your organization follows best practice?

Not sure

5A If yes, what does the organization do to facilitate such practice, and what are the threats to this?

5B If no, what are the inhibitors or barriers to providing better practice? Alternatively, what could be done tofacilitate better practice? A supplementary question – of these inhibitors / contributors which do you think are most important?

- Conflict of interest, sacred cow, political interest, non-cost reflective, some effort from Government, disparity on tariffs,
- Reduction in solar tech, solar farms possible
- Local banks not capacity-