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RESEARCH ARTICLE OPEN ACCESS

Effect of Project Environment on Succes of Rubagabaga Hydropower Project Rwanda

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Abstract:

The objective of this study was to investigate the effect of project environment on success of Rubagabaga hydropower project. The primary aim of the research is to reflect on the problem that call for the conduction of the present study and wanted to answer the following research questions through empirical literature with subjective theories. It was therefore guided by examining the effect of project environment on success of Rubagabaga hydropower project, identify the challenge hydropower plants face in Rwanda and finally investigate relationship between hydro powers and their success? In this research, qualitative and quantitative research design based on statistical data of the research used quantitative and qualitative methods. Questionnaires and interviews were used to collect data. There is a strong positive relationship between environmental assessment of hydropower plant project and socio-economic development. In a nutshell, the researcher has rejected the null hypothesis and considered its alternate. In fact, Community structure and dynamics has positive influence on success of hydropower plant. The changes on community structure and dynamics of hydropower plant project causes the increase of 0.341 (34.1%) of success of rubagabaga hydropower plant. The ration of beta modal results for the t value expressed t=2.66 hence the probability value is significant on socio-economic development noting that sig.=0.009. Carefully, the researcher has rejected the null hypothesis and considered its alternate. Community structure and dynamics has positive influence on socio-economic development. Based on the research results, the researcher recommends the following: There is a need in encouraging projects proposals reflecting on environmental assessment and projects funding strategies should be renewed. Since this type of energy requires a flexible form of technology, there is a need in investing in capacity of water amounts and run of rivers.

Keywords —Community structure and dynamics, socio-economic development, environmental assessment, Economic impacts, hydropower, wind, solar, biomass, ocean energy, biofuel, geothermal, geographical conflicts, greenhouse effect, global warming, regional drought, micro-hydropower, ecological integrity, Concept of variables, Externalized costs, environmental impact assessment, Sustainable Development theory.

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1. INTRODUCTION

This covers the general introduction of the study which will include the background of the study, statement of the problem, objectives of the study, research questions, significance, and scope of the study.

1.1 Background to the study

No water, no life on earth. However, freshwater resources are limited and unevenly distributed by season or location across the world. The availability of adequate quantities of water with the appropriate quality is one of the fundamental requirements for socio-economic development. In the past, the main sources of domestic and industrial water have been

aquifers. Today, many of these are now overused and their rate of recharge is far less than what is extracted. In this regard, one of the most efficient ways to manage and make profit from water resources for human needs is to construct hydropower plant project that create socio-economic and environmental dimensions for the human sharing and distribution.Ancient Greeks used wooden water wheels to convert kinetic energy into mechanical energy as far back as 2,000 years ago. In 1882 the first hydroelectric power plant was built in the United States using a fast-flowing river. Humans in time began creating dams to store water at the most convenient locations in order to best utilize power capacity. Additional engineering and structural changes have followed, providing for a much more complicated process in designing a hydroelectric power plant.The recent development of large hydropower plants in countries like China and Brazil has also stimulated debate about the economic (Ansar t al., 2014), social (Jackson and Sleigh, 2000; Tilt et al., 2009), and environmental (Fearnside, 2006, 2015) effects of these projects. Economic impacts could be positive (e.g. higher income, better infrastructure) if the electricity revenues are shared with the local communities (Koch, 2002), or negative, if local agents absorb the costs associated with hydropower development (e.g., road repairs due to heavy truck traffic (Newell and Raimi, 2015), loss of productive agricultural and forest land (Duflo and Pande, 2007), and reduction of fishing resources (da Silva Soito and Freitas, 2011)). For example, in the case of irrigation dams in India, a study by Duflo and Pande found that agricultural production increased and rural poverty declined in districts located downstream from the dam, but rural poverty increased in the district where the dam was built. Furthermore, with the implementation of high-tension transmission lines, electricity can be transmitted thousands of kilometers away from the generating plant, meaning local communities may not directly benefit from increased electricity supply (Severnini, 2014).Kenya has a number of reservoirs. For instance, the River Tana already has a total of five hydropower reservoirs in the upper catchment with a number (Karura, Mutonga, Low Grand Falls, Usheni, Adamsons Falls, Kora and High Grand Falls) still planned downstream of the existing reservoirs (Snoussi et al., 2007). However, the existing Tana reservoirs were constructed without thorough environmental and social impact assessments (Odingo, 1979). Moreover, some past impact assessment studies focused primarily on areas in the vicinity of the reservoir while ignoring the fact that reservoirs may substantially modify riverine ecosystems hundreds of kilometres downstream. Reservoir planners in Kenya have in the past failed to recognize the linkages between the environment and economic development leading to a number of negative socio-evironmental impacts. Similarly, the government has always assumed that economic, technological and social benefits derived from reservoir establishments are important for the development of the overall country and that spillover effects will eventually improve the livelihoods of the entire population, including those directly affected by the river damming. The energy sources are normally classified as fossil sources, renewable, and nuclear energy sources. Different renewable energy sources, like hydropower, wind, solar, biomass, ocean energy, biofuel, geothermal, etc., provide 15-20% of the total world's energy. The world is turning into a global village given more energy requirements due to fast increasing population, leading to the use of the hydropower plant to realize the energy demand, which creates shaky situations and many difficulties like depletion, environmental, geographical conflicts, greenhouse effect, global warming, and instability in power prices (Maingi& Marsh, 2002). Given the environment-friendly nature and less emission of gases from the energy, it is considered a sustainable energy; also supported for the society from each dimension like economic, social, and environmental (Zelenakova, Zvijakova, &Purcz, P. 2013).

1.2 Statement of the problem

Rwanda's post-conflict recovery resulted in a strong growth in demand for energy. But until 2005, the country suffered from acute shortage of electricity supply, expressed by severe load shedding. The supply shortages and unreliability raised costs of doing business, and simultaneously harmed the prospects of attracting new investment. The country's electricity generation plants (mainly

diesel) had insufficient capacity and suffered from insufficient maintenance, while the hydropower generation had been constrained by regional drought that had also affected Kenya, Tanzania and Uganda, leaving Rwanda with no option of sourcing electricity from its neighbours (2003-2005). In addition, a rather dilapidated transmission and distribution network caused technical losses of around 30%. By 2008, the electricity companyhad only 109,000 households connected to thegrid (RURA, 2008), almost all in the urban area of Kigali, with almost no connections in the rural areas, (Access to Energy in Rwanda, 2014).

The electric power supply is significantly inadequate and 47% of the entire population is gaining access to electricity and Nyabarongo I Hydropower Plant give 12.8% to total Rwanda installed capacity. Considering the current shortfall in electricity supply, power generation is set to grow to over 563 MW from its current capacity of 224.6 MW. Rwanda's major Rivers has proven 333 potential sites for Micro-hydropower countrywide. Opportunities exist in Micro and Small Hydropower projects and shared regional hydropower projects in East Africa (EAC) Partners. A couple of micro and mini, small Hydropower Projects are currently under construction. The largest domestic hydropower project is Nyabarongo I, with an installed capacity of 28MW, (Rwanda Least Cost Power Development Plan, 2019-2050).

In response to the above situation, the Rwandan Government has launched a plan to increase accessibility to rural areas such as the development and upgrading of micro-hydropower (MHP) village electricity mini-grids in cooperation with donors (FDRE 2017). As part of the National Electrification Program (NEP), community-based hydropower plants are being explored as a viable means to harness the country's vast hydropower potential and to sustainably transition from conventional sources of energy into modern energy services and to extend the access to and availability of renewable energy to all community member with attention to vulnerable members like women (FDRE 2017). However, several obstacles may affect the long-term feasibility of community-based hydropower plants such as poor institutional capacity, lack of coordination and inadequate implementation (Sovacool et al. 2011). In addition, while inherent injustices related to the consumption and production of large-scale carbon intense energy systems such as environmental degradation or air pollution are being widely discussed (see e.g. McCauley 2018), low-carbon energy systems in the global south such as micro solutions have new and different justice propositions that need attention.

Diverse power relations within the socio economic and environmental dimensions have negatively as well as positively affected an equal distribution of benefits from micro energy especially in the context of the global south (Nightingale 2011). It is often assumed that electrification primarily benefits society and environment as they are the ones who are responsible for most of the activities in place (Cecelski 1995; Winther et al. 2017). This assumption potentially swells distinct differences in terms of energy needs which produces different outcomes for both aspects and are not fully reflected in energy justice (Bell 2016).

Despite the successful electrification in Rwanda, various difficulties have been identified. For example, the displacement, climate change, deforestation, are currently not compensating what they have extracted from the global ecosystem. The energy justice and the impacts of the electrification project, especially on indigenous, are yet to be explored. Consequently, the aim of this paper is to critically assess these regarding its contribution to energy justice directing attention to socio economic and environmental impacts. In addition, the researcher wants to highlight the importance of incorporating society dimensions into the energy framework and to contribute to the hydropower plants projects in Rwanda.

1.3 Objective of the study

This study focused on the main and specific objectives.

1.3.1 General objective of the study

The general objective of this study was to investigate the effect of projects environment on success of Rubagabaga hydropower project in Rwanda.

1.3.2. Specific objectives of the study

The following specific objectives were formulated to guide the study:

1. To establish the effect of environmental project on success of Rubagabaga hydropower project in Rwanda.
2. To investigate the extend of Community Structure and Dynamics of hydropower plant project on success of Rubagabaga hydropower project in Rwanda.
3. To establish the effect of Government policies, stability and support on success of Rubagabaga hydropower project in Rwanda.

1.4. Research Questions

The research questions are important as they keep the researcher interested and focused on a specific topic.

1. To what extend does Environmental assessment affect success of Rubagabaga hydropower project in Rwanda?
2. How does Community Structure and Dynamics affect success of Rubagabaga hydropower project in Rwanda?
3. What is the effect of existing government policy, stability and support on success of Rubagabaga hydropower project in Rwanda?

1.5. Significance of the study

Different interests were given by the researcher out of this study in order to justify it, researcher have personal, academic, scientific and social interest.There are many times and situations in which more and better information can materially improve planning and significantly enhance the beneficial impacts of developmental projects such as hydropower plant construction. A number of hydropower plant projects which were constructed mainly aimed at providing irrigation water for the large-scale commercial farming activities controlled by a small section of the farming community (Magadlela, 2000). Moreover, little effort was made to assess the socio-economic and environmental impacts of hydropower plant construction in the communal areas. In fact, the countryside population was largely neglected in development planning. Further, there was no attempt that was made to carry out an Environmental Impact Assessment prior to the development of such hydropower plants as Rubagabaga project.This research draws attention to the experience gained from the socio-economic and environmental impacts of Rubagabaga hydropower plant construction. The subject is not only of obvious interest to policy makers in view of the scale of human, natural and financial resources involved. It was also arousing considerable public curiosity, enthusiasm, and concern as a result of the sheer size of the hydropower plant project.

The results from this study might also have a wider application beyond the immediate study area. It is hoped the study was resulting in the sustainable use of Rubagabaga hydropower plant in order to achieve intra-generational socio-economic equity, inter-generational socio-economic equity, and ecological integrity. The concept of sustainability first appeared in the project to advance the idea of sustainable development by noting that economic growth and environmental conservations are not only compatible, but they are necessary partners. One cannot exist without the other.

In brief, this research study will be source of useful data for other researchers and impact investors to understand the impact of such infrastructure projects to the local community and country at large. It will also provide information that can be relied on by the government in making decisions to further facilitate the investors in hydropower plants given the finding of the research and the socio economic and environmental impacts of such projects to the overall development of the country.

1.6. Scope of the study

The study will be carried out in Shyira Sector of Nyabihu District in the communities that live along the riverbanks of Rubagabaga River also neighbouring the Rubagabaga Hydropower Plant. It will mainly focus on how the livelihoods of the neighbouring community was either positively or negatively affected by the power plant. The study population of this research shall be composed by the people living in the neighbourhood of the power plant and at the same time the power plant full time and casual employees who operates and maintain the plant on a daily basis for the plant when it was in operation. The research study will be done in

Shyira Sector in Nyabihu District as the area of the study.

2. LITERATURE REVIEW

2.1. Introduction

This chapter scrutinizes the review of the available literature related to the research under study. The review of the relevant literature considered various sources of information such as textbooks, journals, magazines, and internet (TeferiTessema, &Girum, 2017). Thus, this chapter traces the discourses on the way energy and specifically hydro energy will contribute to improving socio economic and environmental conditions of Rwanda. Under this chapter, the researcher discusses different dimensions in which energy development plays bilateral impacts in the socio economic and environmental development of a country (UNDP, 2016). The local communities are most likely to enjoy the socio-economic benefits of having Rubagabaga hydropower plant in their area. In this chapter, the researcher reviewed the gap and conceptual framework that reflect the relationship among concepts or variables in order to achieve the stated objectives of the study.

2.2. Concept review

Concept of Variables are attributes of an object of study. Choosing which variables to measure is central to good experimental design. Variables in the current research simply are phenomenon that the researcher is trying to measure in some way. Concept of variables is defined as a methodology wherein research is conducted by observing and analysing already present information on a given topic

2.2.1. Socio-economic development

The socio-economic development include increase in access to public goods and services, domestic security, and energy security. Externalized costs and benefits must be weighed to determine the overall impact of a developmental project in the social and environmental realm. Where economic incentive exists; typically, social benefits exist as well. Hydropower plant projects have the potential to manipulate rivers to benefit local populations. Flood protection is an important service that allows communities to live comfortably along a river without fear of volatile flood patterns (Yuksel, 2009). In some scenarios, hydropower plants provide increased water supply for arid populations and increase livelihood value (Workman, 2009). In many scenarios, they are used for hydroelectric production supports other uses such as irrigation contributing to occupations in the agricultural industry, tourism, research and study with service development (Workman, 2009).

In addition, hydropower plants have the potential to increase navigability of waterways allowing increased river transportation of goods and services for the local people (Yuksel, 2009). In many developing nations, hydroelectric power provides electricity generation where other forms are not possible due to limited infrastructure or limited import of fossil fuels (Evans et al., 2009). Hydropower avoids price fluctuations, providing a reliable form of electricity, while fossil fuel prices are constantly fluctuating and in general, increasing with time (Evans et al., 2009). They also strain the relationship between communities and their water bodies. Communities are centred around rivers and other bodies of water because they rely on the water as a resource. In some cases, communities could become isolated from others if river travel is the easiest and most efficient form of transportation. Isolating communities could have detrimental impacts on livelihoods by limiting trade of goods and services once depleted the groundwater or the riverbed is deepened by the project (Yuksel, 2009). While the benefits of a hydropower plant project can be worthwhile, any engagement of natural processes brings economic, environmental, and social impact.

2.2.2. Environmental assessment

An environmental impact assessment (EIA) is an assessment of the possible impact - positive or negative - that a proposed project may have on the environment, considering natural, social and economic aspects. The purpose of the assessment is to ensure that decision makers consider the ensuing

environmental impacts to decide whether to proceed with the project. As a policy instrument the EIA ensures that the environmental implications of a project are anticipated and minimized. They are applied for all types of projects like infrastructure development, and also for hydropower projects (Standal&Winther, 2016).

"An Environmental Impact Assessment (EIA) is a systematic process used to identify, evaluate and mitigate the environmental effects of a proposed project prior to major decisions and commitments being made". It thus also figures as a means to ensure that projects are implemented with full awareness of environmental factors. An EIA normally results in an Environmental Management Plan (EMP) that elaborates mitigation and monitoring measures. In most industrialized countries EIAs are legally required when a proposed (hydropower) project exceeds a certain size (Barros, et al. 2011).

2) 2.2.3. Community Structure and Dynamics

Communities are complex entities that can be characterized by their structure (the types and numbers of species present) and dynamics (how communities change over time). Understanding community structure and dynamics enables community ecologists to manage ecosystems more effectively. Foundation species may physically modify the environment to produce and maintain habitats that benefit the other organisms that use them (Becker, 1994).

Community dynamics are the changes in community structure and composition over time. Sometimes these changes are induced by environmental disturbances such as volcanoes, earthquakes, storms, fires, and climate change. Communities with a stable structure are said to be at equilibrium. Following a disturbance, the community may or may not return to the equilibrium state. Succession describes the sequential appearance and disappearance of species in a community over time. In primary succession, newly exposed or newly formed land is colonized by living things; in secondary succession, part of an ecosystem is disturbed and remnants of the previous community remain (Agarwal & Bina, 2001).

3) 2.2.4. Governmental policies, stability and support

The Guideline aims to provide policy guidance to the agencies responsible for overseeing the implementation of investment projects in the hydropower sector as well as to inform and encourage project developers/investors to be aware of the Government policy toward achieving sustainable development. One of the challenges in creating public-private partnerships is for governments to create an appropriate environment to attract private investment. When governments act in their sovereign role as guardians of the public welfare, they are essentially providers of public goods and services, which in turn may be delivered through public or private channels. When governments implement policy decisions and resolve political conflicts through the legislative and regulatory process, their role is objectively to carry out the will of the body politic (Barros, et al. 2011).

2.3. Theoretical review

4) 2.3.1. Sustainable Development theory

Hydropower and Sustainable Development is a broadly discussed topic. There is two dominant views when it comes to hydropower and its role for Sustainable Development. International River Network (IRN 2004) on the one hand states that, „the technology can only play a role in sustainable energy development if its planning and management are subject to strict guidelines and criteria, alternatives are fully considered and projects are implemented through transparent and accountable processes ".

This perspective has led several financing organizations to develop guidelines and criteria for hydro facilities, with most famous being the World Commission on Dams report in 1998. European Small-Hydropower Association (2004), on the other hand, describes very hauntingly the general view of most project developers concerning impacts on the environment. „regarding the fact, that the production of hydroelectricity does not emit polluting substances, electricity from a hydropower plant could be considered as clean. What can be added is that a special care has to be taken to limit the local environmental impacts of the turbine setting and operations on the ecosystem where the turbine acts ".

5) 2.3.2. Neoclassical sustainability of the growth Theory

The neoclassical vision of economics (Cozzi and Zamagni, 1989) on which are based the neo-liberal policies has as its stated goal the maximization of welfare (Varian, 1990), identified with the willingness to offer to the widest number of people greater opportunities for consumption. The neoclassical theory of growth (or development) considers the increase of production and, therefore, of disposable income in higher levels of consumption as a solution to poverty for progress and development. The neoclassical approach is based on the assumption that the capacity for self-regulation (Tietenberg, 2006) of free markets and not bound, and technological advances can ensure capacity of substitutions endless between the various forms of capital, mitigating so, the constraints arising from the possible scarcity of resources, allow sustainable growth, a level of consumption does not decrease over time.

The rule provides that if royalty or user cost (Tietenberg, 2006) generated by the extraction, according to an efficient plan, of non-renewable resources are fully saved and reinvested in renewable capital, the level of resulting investment would be sufficient to provide a value of the capital stock (economic) at least constant over time, making it possible product levels and consumption of non-decreasing (ie, the sustainability of development). Thus becomes almost irrelevant the fact that is limited the availability of natural resources also non-renewable. In fact, it is possible that consumption levels remain non-decreasing with exhaustible resources that decrease (Musu., 2003), if you do so that the capital stock remains unchanged at least, guaranteeing in any period an adequate investment in man-made capital.

2.4. Empirical review

2.4.1. Environmental assessment project and success of hydropower project

This section discusses concepts of the social construction of nature, place identity, and place attachment in relation to the meaning of wilderness along with how people perceive power plant constructions in natural areas. A description of the geographical concept of topophilia are addressed with the emotional connections between people and the physical environment as a way of admiring the landscape. In this regard, the connection between humans and places has been looked at via the lens of place identity which describes how the physical and symbolic characteristics of places add to peoples' sense of self or identity. Local people usually have more experiences of neighboring areas as they use them more than others and are therefore assumed to develop stronger attachment to the areas. Thus, their opposition to environmental change is expected to be greater than those with weaker place attachments. This relationship has been studied empirically and evaluated the connections between place attachment and the local opposition against a proposed hydropower plant project in an area. It was shown that the stronger local people felt attached to the proposed area the more positive they were towards development, indicating that a power plant in the area would increase the place attachment (AFDB, 2013).

On the other side of the fence is the Ministry of Infrastructure which has to provide more citizens with access to electricity and to deliver a stable supply of energy to businesses. To date, only 46% of Rwandans have electricity. There are however frequent power cuts that affect the production and competitiveness of companies, particularly in the north and in rural areas. It is hard to avoid the impression that the government is too hasty in collaborating with private foreign investors. In recent years, the intervention in bidding processes on several occasions. It deemed the pace of progress of these large-scale projects too slow. The notorious tardiness of the authorities responsible in the drawing-up and granting of the necessary environmental and social impact assessments encourages many bidders to circumvent the requirements. This undermines the trust of all concerned in achieving a fair solution (Beaty, 2000). Regarding environmental impacts, according to the village leaders and cooperative members, the plants do not have many negative impacts the environment. Quite the contrary, it is reported that the reduced rates of deforestation after electrification of the villages. Environmental problems such as landslides and sedimentation occur instead due to population growth and agricultural expansion that

are pushed by hydropower construction (Meder, 2011).

More so, problems of displacement caused by global hydropower development and proposes a new solution that incorporates national and international accountability and provides more protection of the human rights of displaced persons. The current trend of involuntary displacement for hydropower development projects with specific examples from three countries, to depict how nations vary in displacement practices but are nonetheless all unfair to indigenous populations, leading to global human rights violations. It is proposed as global solution to this involuntary displacement problem by involving both national and transnational actors. Nations should, by law, protect their populations from government takings and provide them with opportunities for effective participation and adequate reimbursement (Bailey, 2014).

6) 2.4.2. Community Structure & Dynamics and success of hydropower project

In reality, the performance of hydro-power plant is mainly determined by the parameters of the water that has been directed to the turbine. According to Singh & al. (2011), some of these parameters include the effects of water inertia, water compressibility, pipe wall elasticity in penstock. The effect of water inertia is to ensure that changes in turbine flow do normally lag behind changes in turbine gate opening for a smooth operation. On the other hand, the effect of elasticity introduces some element of pressure and flow in the pipe, a phenomenon known as water hammer. Other parameters of the flowing water also affect the flow of water and indirectly affect the turbine speed which is directly connected to the generator. In order to have constant power generation it is therefore necessary to implement strong control measures to overcome the variability of the initial flowing water (Singh & al. 2011).

Today, the debate about the social liabilities of hydropower development revolves around population displacement and forced resettlement. These are grave issues indeed. Yet, they are not intractable. Three elements explain why displacement processes have overtaken much of the debate around hydropower plants, both in developing countries and developed ones. First, magnitude of human impacts that is large groups of people are adversely affected, profoundly and enduringly, by imposed material losses and social disruptions. Second, absent, or weak regulation frameworks reflected as policies and laws for socially responsible resettlement are still missing now, at the start of the 21st century, in most developing countries. Human rights violations bedevil most displacements. Third, under-financing that incorporates classic economic theory regards cost externalization as an unsound and unacceptable practice (Asemota, & Li, 2018).

In terms of educational benefits, almost all participants highlighted the extended study hours for children to read and do homework after dark when using electric light. From all the answers the average number of hours of studying were 3,2 h per day. Prior electrification, study hours were shorter due to the high costs of kerosene and negative health impacts of wood smoke. Despite the provision of light to study for the schools, electricity has not led to the expansion of additional equipment such as TV or the availability of evening classes for adults or children. One exception is the school in which attained one radio for teaching purposes. The main reasons for this situation are the lack of financial means, availability of teachers and demand for evening classes (Bensch, *et al*., 2011).

It was stated that this was made possible by the decrease in expenditures on energy. Prior to electrification participants were relying on kerosene, candles or firewood for lightening (Wiese 2018), whereas the tariffs for one lightbulb per household are on average 12 ETB per month (Brew-Hammond, 2010). However, the majority of the people from low-income households perceived the tariffs as “too high” due to insufficient and fluctuating income (Bensch, Kluve, Peters, 2011). Furthermore, access to electricity has benefited previous business activities through new appliances such as television or radio and created new economic opportunities innovation: The European Journal of Social Science Research 201 including barbershops, charging services, small businesses and coffee and tea shops (Dryden, 1982). According to all three village leaders, electricity has led to poverty reduction. Yet,

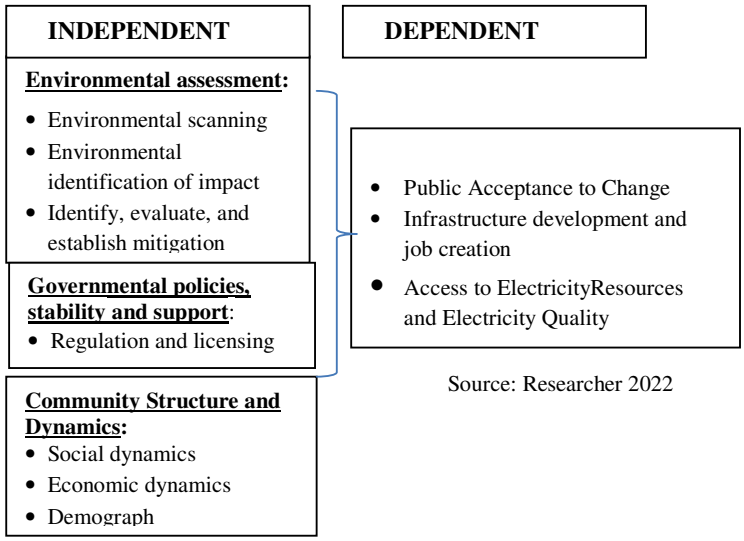
it has not improved the access to financial institutions in all three villages.

7) 2.4.3. Governmental policies, stability & support and Hydropower Projects

Risk reduction is one of government's most important roles in promoting private investment in the electricity sector. Reducing the number of potential unknowns is especially important where there is little or no experience with renewable technologies at the national or local level. Government leadership in risk reduction can take many forms. Areas where it may be appropriate for the government to play a role include: national energy planning; resource evaluation; market evaluation; least-cost-planning; providing access to expertise; eliminating obstacles to equitable markets; project oversight and evaluation; and assistance in providing access to capital and financing (Alam, 2013).

One of the challenges in creating public-private partnerships is for governments to create an appropriate environment to attract private investment. When governments act in their sovereign role as guardians of the public welfare, they are essentially providers of public goods and services, which in turn may be delivered through public or private channels. When governments implement policy decisions and resolve political conflicts through the legislative and regulatory process, their role is objectively to carry out the will of the body politic (McCauley *et al*., 2013).

2.5. Conceptual Framework



Source: Researcher 2022

The figure above shows the conceptual framework model of the study. From this figure, the concept framework model shows that impact factors related to socio-environmental variables as dependent variable connected to hydropower plant project variables were conceptualized respectively as independent variables. It also attempts to explain the relationship that exists between the dependent and independent variables. Similarly, the present study puts an emphasis on the analysis of the dependent variables which is socio-environmental impact captured from independent variable that is hydropower plant in the framework.

2.6. Research gaps

Energy is a major strategic issue that concerns the overall social, economic, and environmental development. Hydro energy is a very important part of Rwanda's energy, but the development and utilization rate of our water resources development is relatively low. Subsequently, active planning for the development of hydroelectric energy, handling the major relationship of the hydropower development properly, resolving the key and difficult problems in the current hydropower development, and promoting a comprehensive, coordinated and sustainable development of hydroelectric energy are the imperative needs of meeting the rapid development of the national sustained economy.

It is in this regard that hydropower plays an important role in the development of the country as it provides power at cheaper rate being perpetual and renewable sources of energy. In hydroelectric power plant, the energy of water is utilized for generating electricity which is pollution free and also inflation free energy due to absence of fuel costs. Apart from the clean and cost economic nature of power, the other key advantage includes an inherent ability for sudden starting, stopping and load variations which helps in refining reliability of power system. In other words, hydroelectric power defines the usage of water resources towards inflation free green energy in the absence of fuel cost with mature technology characterized by highest prime moving efficiency and spectacular operational flexibility.

3. RESEARCH METHODOLOGY

3.0. Introduction

This chapter showcases the way the researcher gathered, analyzed, and interpreted the data to the research questions. It explains the research design, target population, sampling procedures and sample size, research instruments, validity procedures, reliability, data collection and data analysis procedures.

3.1. Research design

9) Christensen (2011) defines research design as the out plans or strategies specifying the procedures to be used in looking for an answer to the research questions and objectives. It specifies such things as how to collect and analyze the data. With reference to the purpose of this study on socio- economic and environmental impacts of hydropower plant projects in Rwanda. The present research involved qualitative and quantitative research design deemed necessary to the description of the data that was collected. According to Ross (2005), quantitative research method is used when the research problem is a description of trends or an explanation of the relationship among variables. The same author argues that descriptive research determines and reports on the way things are and collects data to test hypotheses or answer questions about the current status of the subject study. With reference to the above definitions, this study will be descriptive study because it describes the socio-economic and environmental impacts and hydropower in Nyabihu District. Moreover, the researcher used descriptive design because this study intends to explore the relationship between variables studied.

3.2. Sampling design

This sampling frame consisted a sample size and sampling techniques used in the study.

8) 3.3.1. Population of the study

This research was targeting mainly the population surrounding Rubagabaga hydropower plant located in Shyira sector Nyabihu district. According to Cooper and Schindler (2010), a population is the total collection of elements about which we wish to make some inferences. It is a group of individuals, objects or items from which samples are taken for measurement. It is a complete set of elements that possess some common characteristics defined by the sampling criteria established by the researcher including the fact that they are the ones' experiencing the impacts of this hydropower plant under discussion. A sample was taken from a larger group or a population. The target population of this study is a total number of 252 households including people from villages with immediate neighboring the plant in the sector in Nyabihu District from which a sample will be randomly selected as indicated in 3.3.2 unit.

3.3.2. Sample Size Determination

The determination of the sample size of this research was indicated as 154 basing on Solvins' formula as stated belowand declares that for a population of 252 individuals or households, the sample can be 154 as sample size. Therefore, the sample size was 154 as the total sample made of people from the local community with a close relationship with Rubagabaga hydropower plant project located in the district.

Given:

n = Sample size

N =Study population

e= margin of error which determined based on the confidence level (expressed in percentages).

For the purpose of this study, the sample is calculated as follows.

N= 252

Confidence level=95% thus, e=0.05

$$n = \frac{\mathrm{N}}{1 + \mathrm{N}(0.05)^2}$$

Then $n = \frac{252}{1+252(0.05)^2}$ =154

3.3.3. Sampling technique

Simple random sampling technique will be used because it allows every member of the population to have an even chance and likelihood of being selected in the sample. Therefore, the selection of respondents completely depends on chance or by probability. The researchers assume that they can use their knowledge of the population to judge whether or not a particular sample was representative (Wallen, 2006). In this study, simple random sampling was applied to all villages surrounding the hydropower plant.

3.4. Instruments of data collection

In data collection, the researcher used questionnaires and interview. Questionnaires and interview were translated and transcribed from English to Kinyarwanda and administered to the

respondents to facilitate the respondents answer to the questions. The researcher also used library and internet-based method as instruments for data collection related to socio- economic and environmental impacts of hydropower plant. The cause of using different methods, commonly known as triangulation, is to get rich data enabling the researcher to properly achieve the objectives.

For the present work to avoid biased, inadequate and surface information, hence, to gather and capture the richness and fullness of an experience, it made use of questionnaire and semi-structured interview. The latter requires that the information be derived from an intensive exploration with participants (Polkinghorne, 2005). As noted above, the interview is suitable for this research because it collects data from the individuals' lived experiences and perceptions regarding what and how they understand the socio- economic and environmental impacts of hydropower plant. More so, McLeod (2018), defines a questionnaire as a research tool with categories of questions for the purpose of gathering information from respondents. He adds that questionnaires can be thought of as a kind of written interview.

Likewise, the questionnaires were used to link the respondents and the researcher. They comprised of two main categories of questions that is demographic questions and closed questions. These questions were useful in obtaining detailed information concerning the link between socio-economic and environmental impacts of hydropower plant. These were in form of structured and non-structured questions aiming at collecting data from the respondents.

The structured questions are going to be used to collect quantitative data while structured interview was used to collect qualitative data. In this regard, the researcher engaged semi-structured interview to help him probing and pay attention, in the questioning format for the researcher, to hear and get the respondents' mood and elicit more valid data. It was used as an interview protocol for the researcher whereby the latter may provoke many answers from the respondents. This is meant that some questions will be prepared so as for the researcher to guide the interview towards the satisfaction of research questions, but additional questions were also made encountered during the interview (Ngozwana, 2017).

3.5. Data collection procedures

As mentioned above, data collection procedures reflected as questionnaires give the respondents an opportunity to answer in their own way that works for them. However, the majority of the questions were multiple-choice, closed-ended questions based on a five-point Likert scale that are namely 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree. Certain means were calculated from the results in order to make a comparison between different aspects possible.

3.5.1. Questionnaire

These questionnaires are mode of closed questions and will be distributed to the respondents who are of course able to answer themselves these questions that finally serve to get rich data enabling the researcher to properly achieve the objectives. This method helped the researcher to save time, because in a short time all the informant had finished responding, hence the sufficient time to the researcher for data preparation.

3.5.2. Interview guide

The main purpose of conducting the interview was to "develop a detailed understanding that might provide useful information and that might help people learn about the phenomenon" (Creswell, 2007). The interview protocol for this study is developed based on research questions that the study wants to respond. Some of open-ended questions are designed to collect data on socio-economic and environmental impacts of hydropower plant. In this regard, the opportunities, challenges for hydropower plant was also reflected in line with the interview as detailed in appendix (Yin, Robert, 2011).

Moreover, the researcher has indeed employed interview, as much as data collection tools is concerned, the researcher was engaged semi-structured interview to help him probing and pay attention, in the questioning format for the researcher, to hear and get the respondents' mood and elicit more valid data. It was used as an interview protocol for the researcher. This is meant that some questions were prepared so as for the researcher to guide the interview towards the satisfaction of research questions, but additional

questions were also made during the interview (Ngozwana, 2017).

3.6. Reliability

According to Saunders *et al*., (2007), reliability means the degree to which the data analysis procedures and data collection techniques yield consistent results. Reliability is an indicator of consistency, i.e., an indicator of how stable a test score or data is across applications or time. In this study, the measure was assessed to produce similar results consistently then since the measures gave the same "results." A measure can be reliable without being valid.

This study initially employed the test-retest reliability as a type of (also called Stability) answers the question, to determine whether the scores would be stable over time." Sometime later, the same test will be re-administered to the same or highly similar group. With a reliability coefficient of $r = 0.70$, giving evidence of consistency, while coefficient below 0.7 was rejected. In this case, whenever the coefficient was greater 0.7, which indicated that the constructs have high reliability.

3.7. Validity

Ochieng (2009) argues that, for a study to be real meaning, it has to apply valid and reliable instruments. Before actual research to be done, pre-test will be done, validity and its reliability will also be established.

Validity means ascertaining the accuracy of the instruments by establishing whether the instruments focus on the information they are intended to collect. In order to ascertain face validity, the instruments were constructed and handed to the supervisor for constructive criticism. Thereafter, they were revised according to the supervisor's comments. In addition, content validity was also sought by requesting four experts in field of study to provide their comments on the relevance of each item on the instrument. The experts were requested to indicate whether the item is relevant or not. The results of their indications were analyzed to establish the percentage representation using content validity index. Content Valid Index (CVI) is a scale developed by computing or ranking the relevant items in the instrument or questionnaires by checking their clarity, their meaningfulness in line with all objectives stated dividing by the total number of items (Neville, 2007). Content Validity is the degree to which an instrument has an appropriate sample of items for the construct being measured and is an important procedure in scale development. CVI is the most widely used index in the quantitative evaluation. According to Amin (2005), the CVI of above 0.6 is an appropriate validity.

3.8. Data analysis

The collected raw data was inspected to ensure it is complete and accurate. Questionnaires were organized and classified according to the study objectives. Qualitative data was classified and coded into themes and concepts for analysis based on objectives of the study. This study employed Karl Pearson's coefficient of correlation. The Karl Pearson's coefficient of correlation is a method which was used for measuring the degree of relationship between two variables. Since the symbol used to identify Pearson's Correlation Coefficient is a lower case "r", it is often called "Pearson's r". This coefficient assumes that there is linear relationship between the two variables that the two variables are casually related which means that one of the variables is independent and the other one is dependent; and many independent causes are operating in both variables so as to produce a normal distribution.The model that used in this study is Chi-square test distribution, this facilitated to verify the possible relationship between two categorical variables. Its symbol is "x squared" (x^2). This is a commonly used statistical procedure. Regression analysis is a set of statistical methods used for the estimation of relationships between a dependent variable and one or more independent variables. It was utilized to assess the strength of the relationship between variables and for modelling the future relationship between them.

3.9. Ethical considerations

The goal of ethics in research was to ensure that no one is harmed or suffers adverse consequences from research activities (Cohen et al, 2007). The researcher strictly observed the following: Confidentiality: The participants were guaranteed that the information they provided would not be

made available to anyone who is not involved in the study and they remain confidential for the purposes it is intended for; Permission: The researcher seek a permission letter from University of Kigali (UoK) which was presented to the school authorities as an insurance of academic purpose; Informed consent: The prospective research participants were fully informed about the procedures that involved in the research and was asked to give their consent to participate; Anonymity: The participants were remained anonymous throughout the study, even to the researcher so as to guarantee their privacy.

4. PRESENTATION, ANALYSIS AND INTERPRETATION OF FINDINGS

In this section, the researcher has interpreted the findings in a systematic way. The main objective of the study aimed at evaluating the effects of hydropower plant on socio-economic development in Rwanda. Supportively, the study has worked on specific objectives establishing the effects of environmental assessment of hydropower plant project, the extend of community structure and dynamics of hydropower plant project, the effect of government policies, stability and support on socio-economic development in Rwanda. The data obtained from field has been presented in form of qualitative and quantitative which allowed the researcher to give accurate explanations of the findings in general.

4.1. Rate of respondents

11) 4.1.1. Response rate of respondents

Participants	Frequencies	Percent
Returned questionnaires	143	92.9%
Questionnaires not returned	11	7.1%
Total of Distributed questionnaires	**154**	**100%**

Table 4.1: Rate of respondents
Source: Field data (2022)

All distributed questionnaires weren't returned at the level of 7.1 percent, means that 154 questionnaires distributed among them, 143 were returned equivalent to 92.9% and 11 questionnaires equivalent to 7.1% were not returned.

4.2. Descriptive statistics

Using descriptive statistics was helpful in terms of simplifying large amount of data in an easy and sensible way. It is very easy to summarize the data and consider a small number of variables and data which easy the interpretation. Hayes & Smith (2021) define descriptive statistics as the coefficient that help a researcher to summarize the data by breaking them into sections indicating the mean. It is the best easy way to collect, analyse and interpret the data and measure the variability. While describing the descriptive statistics, I have put my focus on interpreting the mean, skewness, and kurtosis to know how the data I have are distributed in form of peaks, substantially distributed, or making a flat distribution.

4.2.1. Descriptive statistics of Environmental assessment

Table 4.2: Skewness and Kurtosis of Environmental assessment

Descriptive Statistics							
	N	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Ensure that decision makers consider the ensuing environmental impacts to decide whether to proceed with the project	143	4.9580	.23359	-6.172	.203	41.519	.403
Ensures that the environmental implications of a project are anticipated and minimized	143	4.9790	.14382	-6.756	.203	44.262	.403
Identify, evaluate and mitigate the environmental effects of a proposed project prior to major decisions and commitments being made	143	4.9860	.11785	-8.365	.203	68.943	.403
Elaborates mitigation and monitoring measures	143	4.9580	.23359	-6.172	.203	41.519	.403

Source: Field data (2022).

The objective of environmental impact assessment is to offer to easy way for the decision makers in order to adjust matters that are usually related to a new or an upcoming project (Env.gov, n.d.). As per table no.2, the table described the descriptive statistics indicating the mean, Kurtosis, skewness, for the Environmental assessment. On the side of the mean, the range in which it is calculated was found to be 4.95 and 4.98 indicating a small difference existing between the factors. Starting with the factor "Ensure that decision makers consider the ensuing environmental impacts to decide whether to proceed with the project" with the mean of 4.95. the factor Identify, evaluate and mitigate the environmental effects of a proposed project prior to major decisions and commitments being made." with the mean 4.98. Therefore, the factors are closely related. The values of kurtosis ranges from 41.51 up to 68.94 indicating that all values are in a positive range. As a rule of thumb, the positive data of kurtosis indicate how the data is too peaked, otherwise could be showing a flat distribution. And again, the values of skewness ranges from -8.36 as the lowest value up to -6.75 as the highest value. Therefore, the data sample indicated a substantially distributed data form. Eustache et al (2020) conducted a similar research demonstrating how hydropower should be considered as the primary renewable resource of energy in Rwanda. In this study, it was found that the overall installed capacity of power was about 224.6 MW which means that hydropower makes or contribute up to 46.9%. However, there is a need in encouraging project proposals which will mitigate the environmental effect of a proposed project prior to major decisions and commitments being made.

4.2.2. Descriptive statistics of Community Structure

Table 4.3: Skewness and Kurtosis of Community Structure

Descriptive Statistics							
	N	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Community Structure and Dynamics of hydropower plant made local community Health, well-being and vitality	143	4.9720	.20363	-8.038	.203	69.180	.403
Community Structure and Dynamics of hydropower plant made Cultural well-being	143	4.9650	.18434	-5.117	.203	24.527	.403
Community Structure and Dynamics of hydropower plant provided Community stability	143	4.9860	.11785	-8.365	.203	68.943	.403
Community Structure and Dynamics of hydropower plant facilitated Services and infrastructure	143	4.9930	.08362	-11.958	.203	143.000	.403
Community Structure and Dynamics of hydropower plant facilitate Education and training	143	4.9860	.11785	-8.365	.203	68.943	.403

Source: Field data (2022)

Interpreting the table no.3, the descriptive statistics indicating the mean, Kurtosis, skewness, for the Community structure. Starting with the mean, the range in which it is calculated was found to be 4.96 and 4.99 indicating a small difference existing between the factors. Starting with the factor "Community Structure and Dynamics of hydropower plant made cultural well-being" with the mean of 4.96 and the factor "Community structure and dynamics of hydropower plant facilitated services and infrastructure." with the mean 4.99. Therefore, the factors are closely related. The values of kurtosis ranges from 24.52 up to

143.000 indicating that all values are in a positive range. As a rule of thumb, the positive data of kurtosis indicate how the data is too peaked, otherwise could be showing a flat distribution. And again, the values of skewness ranges from -11.78 as the lowest value up to -5.11 as the highest value. Therefore, the data sample indicated a substantially distributed data form. In agreement with Naeem (1990), the complexity differences existing in distribution of resources may hinder a better performance and satisfaction of community as well as the members of a given society. Some factors are highly related to both direct and indirect resource-mediated factors that significantly create abundance of species in a society hence maintaining the ecology and satisfaction among the people.

4.2.3. **Descriptive statistics of Government policies**

Table 4.4: Skewness and Kurtosis of Government policies

Descriptive Statistics							
	N	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Provide policy guidance to the agencies responsible for overseeing the implementation of investment projects	143	4.9860	.11785	-8.365	.203	68.943	.403
Inform and encourage project developers/investors	143	4.9720	.20363	-8.038	.203	69.180	.403
Be aware of the Government policy toward achieving sustainable development	143	4.9860	.11785	-8.365	.203	68.943	.403

Source: Field data (2022)

Analyzing no.4, the table described the descriptive statistics indicating the mean, Kurtosis, skewness, for the government policies. On the side of the mean, the range in which it is calculated was found to be 4.97 and 4.98 indicating a small difference existing between the factors. Starting with the factor "inform and encourage project developers/investors" with the mean of 4.97 and the factor "Provide policy guidance to the agencies responsible for overseeing the implementation of investment projects." with the mean 4.98. Therefore, the factors are closely related. The values of kurtosis ranges from 68.94 up to 69.18 indicating that all values are in a positive range. As a rule of thumb, the positive data of kurtosis indicate how the data is too peaked, otherwise could be showing a flat distribution. And again, the values of skewness ranges from -8.36 as the lowest value up to -8.03 as the highest value. Therefore, the data sample indicated a substantially distributed data form.

4.2.4.Descriptive statistics of hydropower plant project on success of hydropower project in Rwanda

Table 4.5: Skewness and Kurtosis of hydropower plant project on success of hydropower project

Descriptive Statistics							
	N	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
The hydropower plant developed Public Acceptance to Change and learning system	143	4.9510	.24692	-5.557	.203	33.660	.403
The hydropower plant influenced Infrastructure development and job creation	143	4.9790	.14382	-6.756	.203	44.262	.403
The hydropower plant subsidized Access to Electricity Resources and Electricity Quality	143	4.9860	.11785	-8.365	.203	68.943	.403
The hydropower plant promoted the Tourism	143	4.9650	.18434	-5.117	.203	24.527	.403
The hydropower plant influenced Health and Safety	143	4.9650	.21924	-6.966	.203	52.623	.403
The hydropower plant provided Air Quality	143	4.9580	.20120	-4.618	.203	19.597	.403

Source: Field data (2022)

One of the common benefits that hydropower plants have is that they are able to generate power to the

grid immediately and they are able to serve as another source of power in case electricity outages or disruptions occur (Water Power technology office USA). Due to the fact hydropower energy is usually fueled by water, this energy is always clean and there is no much air or water pollution indicated or existed during the consumption of this energy. As per table no.5, the table described the descriptive statistics indicating the mean, Kurtosis, skewness, for the hydropower plant project on socio-environment sustenance and development. On the side of the mean, the range in which it is calculated was found to be 4.95 and 4.98 indicating a small difference existing between the factors. Starting with the factor "They hydropower plant developed public acceptance to change and learning system" with the mean of 4.95 and the factor "the hydropower plant subsidized access to electricity resources and Electricity Quality." with the mean 4.98. Therefore, the factors are closely related. The values of kurtosis ranges from 19.59 up to 68.94 indicating that all values are in a positive range. As a rule of thumb, the positive data of kurtosis indicate how the data is too peaked, otherwise could be showing a flat distribution. And again, the values of skewness ranges from -8.36 as the lowest value up to -4.61 as the highest value. Therefore, the data sample indicated a substantially distributed data form.

4.5.2.Testing objective two: To investigate the extend of Community Structure and Dynamics of hydropower plant project on success of Rubagabaga hydropower project in Rwanda.

Table 4.6: Anova table of relationship between Community Structure and Dynamics of hydropower plant project on success of Rubagabaga hydropower project in Rwanda.

ANOVA[a]						
Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	.468	3	.157	5.190	.000[b]
	Residual	2.469	137	.018		
	Total	2.937	142			

Source: Field data (2022)

The Anova table no.4.6 provided a summarized information for the extent of community structure and dynamics of hydropower plant project on social environmental sustenance and development in Rwanda. The regression equation shows how that the data are fit and predict the changes happening to the dependent and independent variables through a statistical significance the p value equivalent to 0.000 which is under 0.05. Meaning that $p<0.05$. Hitting the point, the regression model is observed as statistically strong and the variables are significant.

Table 4.7: Model summary table of relationship between Community Structure and Dynamics of hydropower plant project on success of Rubagabaga hydropower project in Rwanda.

Source: Field data (2022)

As per table no.7, the model summary shows the way in which community structure of hydropower plant project affect the socio- economic development. The data demonstrated the proofs for the second objective of this study. Two important

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.399[a]	.159	.129	.13425

values that is R and R square demonstrated the rates at which the relationship between two variables is established. Usually, the R value indicated the rate at which two variables correlated which is supported by the R square indicating the total variation between the variables. The R value was estimated to 0.399 indicating a positive relationship between the variables. The R square demonstrated a value of 0.159 or estimated to 15.9% indicating the total variation at which community structure of hydropower project and socio-economic development affect each other. In a nutshell, there is a relationship existing between Community structure of hydropower plant project and socio- economic development and the relationship can be explained.

4.5.3. Testing objective three: To establish the effect of Government policies, stability and support on success of Rubagabaga hydropower project in Rwanda.

Table 4.8: Anova table of relationship between Government policies, stability and support on success of Rubagabaga hydropower project in Rwanda.

ANOVA[a]						
Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	.479	3	.160	14.880	.000[b]
	Residual	1.493	139	.011		
	Total	1.972	142			

Source: Field data (2022)

The national environment Policy sets out different objectives and so many other fundamental principles that help in improving management of the environment and central sectoral cross-cutting policies that will boost the management authority of the environment (Rwanda Environment Policy, 2003). However, the awareness of environment goes back the past as the action taken only aimed at protecting and conservation of the environment under active circumstances and political benefits. The Anova table no.8 provided a summarized information for the effect of Government policies, stability, support on social environmental sustenance and development in Rwanda. The regression equation shows how that the data are fit and predict the changes happening to the dependent and independent variables through a statistical significance the p value equivalent to 0.000 which is under 0.05. Meaning that p<0.05. To wind up, the regression model is observed as statistically strong and the variables are significant.

4.6. Predicting the Effect of Objectives

Table 4.9: Coefficient of hydropower plant projects onsocio-economic development

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	Environmental assessment	3.012	1.291	.397	2.333	.021
2	Community Structure and Dynamics	2.843	1.066	.341	2.668	.009
3	Government policies, stability and support	2.590	.570	.478	4.543	.000

Source: Field data (2022)

4.6.1.Effect of Environmental assessment project on success of hydropower plant

The table above shows beta= 0.397 with the t value of 2.333 as the p value was 0.021. the p value is less than 0.05. Therefore, I rejected the null hypothesis and considered it alternate. There is a strong positive relationship between environmental assessment of hydropower plant project and socio-economic development.

4.6.2.Effect of Community Structure and Dynamics of hydropower plant project on success of Rubagabaga hydropower plant

The table above shows beta= 0.341 with the t value of 2.668as the p value was 0.009. the p value is less than 0.05. Therefore, I rejected the null hypothesis and considered it alternate. There is a strong positive relationship between community structure of hydropower plant project and the success of the powerplant

4.6.3. Effect of Government policies, stability and support on success of the hydropower plant project

The table above shows beta= 0.478 with the t value of 4.543 as the p value was 0.000. The p value is less than 0.05. Therefore, I rejected the null hypothesis and considered it alternate. There is a strong positive relationship between government policies, stability and support on socio-economic development

4.7. Chi-square test

4.7.1. Chi-square test of Environmental assessment

The test indicated the asymptotic sig. value (2-sided) which has shown the Pearson value for the environmental assessment estimated at 0.835. This p value demonstrated that the p value exhibiting a high strong and positive relationship linking two variables. Therefore, environmental assessment contributes to the improvement of socio-economic development in Rwanda.

4.7.2. Chi-square test of Community Structure and Dynamics

Table 4.10:Chi-square test of Community Structure and Dynamics

Chi-Square Tests					
	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.029[a]	1	.865		
Continuity Correction[b]	.000	1	1.000		
Likelihood Ratio	.057	1	.812		
Fisher's Exact Test				1.000	.972
Linear-by-Linear Association	.029	1	.866		

Source: Field data (2022)

According to the table no.10, chi-square test for the community structure is projected. The test indicated the asymptotic sig. value (2-sided) which has shown the Pearson value for the environmental assessment estimated at 0.865. This p value demonstrated that the p value has shown that there is a positive and strong relationship linking two variables. Therefore, community structure contributes to the improvement of socio-economic development in Rwanda.

4.7.3. Chi-square test of Government policies, stability and support

Chi-square test for the government policies, stability and support is presented. The test indicated the asymptotic sig. value (2-sided) which has shown the p value or Pearson value for the environmental assessment estimated at 0.835. This p value demonstrated that there is a high and positive relationship linking two variables. In closing, environmental

assessment contributes to the success of hydropower project in Rwanda.

4.8. Correlation analysis

4.8.1. Correlation matrix of hydropower plant projects on socio-economic development

Table 4.11: Correlation matrix of hydropower plant projects on success of hydropower project

	Success of hydropower project	Environmental assessment	Community Structure and Dynamics	Government policies, stability and support
Success of hydropower project	1			
Environmental assessment	.533**	1		
Community Structure and Dynamics	.493**	.272**	1	
Government policies, stability and support	.398**	.254**	.208*	1
* Correlation is significant at 0.5 level (2-tailed) ** Correlation is significant at 0.01 level (2-tailed)				

Source: Field data (2022)

As a simple interpretation from the table per no. 4.11, the correlation exists between Environmental assessment and the success of hydropower project in Rwanda it was measured at 0.533**. This value shown from the table above signifies how strong the relationship between the variables as it is a positive degree to which Environmental assessment and success of hydropower project. We noticed that the p value was 0.000 (2-tailed) which also support the fact that there is a strong and positive linear connection between the two variables tested in this study. Moving forward, the researcher has accepted the hypothesis above by saying that Environmental assessment has significant positive effect on the success of hydropower project.

Studying the table as per no. 4.20, the correlation exists between Community Structure and Dynamics and success of hydropower project was measured at 0.493**. This value shown from the table above signifies how strong the relationship between the variables as it is a positive degree to which Community Structure and Dynamics and success of the project. Additionally, we noticed that the p value was 0.000 (2-tailed) which also support the fact that there is a strong and positive linear relationship between the two variables tested in this study. In closing, the researcher has accepted the hypothesis above by saying that Community Structure and Dynamics has significant effect on success of hydropower project.

Looking over the table per no. 4.20, the correlation between Government policies, stability and support and success of hydropower project in Rwanda was found to be at 0.398**. This value shown from the table above demonstrate how strong the relationship between the variables as it is a positive degree to which Government policies, stability and support and success of hydropower project. We noticed that the p value was 0.000 (2-tailed) which also support the fact that there is a strong and positive linear connection between the two variables tested during the research. To sum up, the researcher has accepted the hypothesis above by saying that Government policies, stability and support has significant effect on success of hydropower project in Rwanda.

4.9. Test of Null Hypothesis Predicting the Effect of Objectives

Before concluding on the hypothesis, the researcher followed a scientific method to confirm if the hypothesis would be true. The table below demonstrated the degree to which the dependent and independent variables correlate indicated both standardized and unstandardized coefficients testing for the factors.

Back to the research questions of the study, the first question assessed the extent at which Environment assessment project assist in success of hydropower project in Rwanda, the second question assessing how community structure and dynamics of hydropower plant help in the success of the hydropower projects in Rwanda, and the third question analyzing the contribution of existing government policy, stability and support in success of hydropower project in Rwanda.

Table 4.12: Testing hypothesis by Coefficient of Electronic procurement

Coefficients[a]						
		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	Environmental assessment	3.012	1.291	.397	2.333	.021
2	Community Structure and Dynamics	2.843	1.066	.341	2.668	.009
3	Government policies, stability and support	2.590	.570	.478	4.543	.000

Source: Field data (2022)

4.9.1. Environmental assessment of hydropower plant project has no positive effect success of Rubagabaga hydropower plant

According to the table no.21, Y= $\alpha+\beta_1X_1$ +ę and β=.397 projecting that the changes on Environmental assessment causes the increase of 0.39 (39.7.0%) of the socio-environment sustenance and development. The ration of beta modal results for the t value expressed t=2.33 hence the probability value is significant on socio-environment sustenance and development noting that sig.=0.021 since the value of p is less than 0.05, the researcher has rejected the null hypothesis and considered its alternate confirming that environmental assessment of hydropower plant project has positive effect on success of the project.

α: -Y Intercept

β: -Regression coefficient

I : -success of the project.

Sig. =0.000, t=2.33

$\beta \neq 0$: Reject Ho if $\beta_{1\ is} \geq \alpha$

Reject the Null hypothesis

12) 4.9.2. Community Structure and Dynamics of hydropower plant project has no positive effect on success of hydropower plant

According to the table no.21, Y= $\alpha+\beta_1X_1$ +ę and β=.341 projecting that the changes on community structure and dynamics of hydropower plant project causes the increase of 0.341 (34.1%) of the success of hydropower project. The ration of beta modal results for the t value expressed t=2.66 hence the probability value is significant on success of hydropower project noting that sig.=0.009 since the value of p is less than 0.05, the researcher has rejected the null hypothesis and considered its alternate. In fact, Community structure and dynamics has positive influence on success of the hydropower project

α: - Y Intercept

β: - Regression coefficient

I : - success of hydropower project

Sig. =0.000, t=2.66

$\beta \neq 0$: Reject H1 if $\beta_{1\ is} \geq \alpha$

Reject the Null hypothesis

13) 4.9.3. Government policies, stability and support of hydropower plant project has no positive effect on success of hydropower project

According to the table no.21, Y= $\alpha+\beta_1X_1$ +ę and β=.478 projecting that the changes on government policies, stability and support of hydropower plant project causes the increase of 0.478 (47.80%) of the success of the hydropower project. The ration of beta modal results for the t value expressed t=4.54 hence the probability value is significant on success of hydropower project noting that sig.=0.000 since the value of p is less than 0.05, the researcher has rejected the null hypothesis and considered its alternate confirming that Government policies, stability and support of hydropower plant project has positive effect on success of hydropower project.

α: - Y Intercept

β: - Regression coefficient

I : - success of hydropower project.

Sig. =0.000, t=4.54

$\beta \neq 0$: Reject Ho if $\beta_{1\ is} \geq \alpha$

Reject the Null hypothesis

5. SUMMARY

5.0. Introduction

Throughout this section, I have presented the summary of the findings on objectives and the hypothesis of the research. This has enabled me to establish conclusions and recommendations in the end. The main objective of this study worked to assess the effects of environment project on success of rubagabaga hydropower plant Rwanda. Supportively, the study has worked on specific objectives establishing the effects of environmental assessment of hydropower plant project, the extent of community structure and dynamics of hydropower plant project, the effect of government policies, stability and support on success of the hydropower in Rwanda. I recognized the gap existed in this study which lead me to provide other areas of future studies.

5.1. Summary of Findings

14) 5.1.1. Summary on objective one: Effect of Environmental project on success of Rubagabaga hydropower plant in Rwanda.

Referring to the table no.10, the results for the effect of environmental project on success of rubagabaga hydropower plant in Rwanda was demonstrated. The regression equation proven how that the data are fit and predict the changes that the independent variable brought to the dependent variable and vice-versa. The p value was equivalent to 0.11 which is under 0.05. Meaning that $p<0.05$. In fact, the regression model was observed as statistically strong and the variables were significant. Successively, the table no.11 projected the model summary showing the way in which environmental assessment of hydropower plant project affect the success of hydropower project. The data demonstrated the proofs for the first objective of this study using two values that is R and R square demonstrated the rates at which the relationship between two variables is established. The R value was estimated to 0.300 indicating a positive relationship between the variables. The R square demonstrated a value of 0.09 or estimated to 9% indicating the total variation at which environmental assessment of hydropower project and the success of hydropower project affect each other. In closing, there is a relationship existing between environmental assessment of hydropower project and success of hydropower project and the relationship can be explained.

15) 5.1.2. Summary on objective two: Investigating the Extent of Community Structure and Dynamics on Success of hydropower project in Rwanda.

The Anova table no.12 provided a summarized information for the extent of community structure and dynamics of hydropower plant project on the success of hydropower project in Rwanda. Referring to the table, the regression equation proven how that the data are fit and predict the changes that the independent variable caused to the dependent variable and vice-versa. The p value was equivalent to 0.000 which is under 0.05. Meaning that $p<0.05$. Moving forward, the regression model is observed as statistically strong and the variables are significant. As per table no.13, the model summary projected the way in which community structure of hydropower plant project affect success of the project. The data demonstrated the proofs for the second objective of this study using the R value indicated the rate at which two variables correlated which is supported by the R square indicating the total variation between the variables. The R value was estimated to 0.399 indicating a positive relationship between the variables. The R square demonstrated a value of 0.159 or estimated to 15.9% indicating the total variation at which community structure of hydropower project and success of hydropower project affect each other. As a researcher, I safely concluded that there is a relationship existing between Community structure of hydropower plant project and socio-economic development and the relationship can be explained.

16) 5.2.3. Summary on objective three: Establish the effect of Government policies, stability and support on success of hydropower project in Rwanda.

Referring to the Anova table no.14, the effect of Government policies, stability, support on social environmental sustenance and development in Rwanda. The regression equation has shown how that the data are fit and predict the changes happening to the dependent and independent variables through a statistical significance the p value equivalent to 0.000 which is under 0.05. Meaning that $p<0.05$. As a simple observation, the regression model is observed as statistically strong and the variables are significant. In the table no.15, the model summary shows the way in which government policies, stability and support of hydropower plant project affect the success of hydropower poject. The data demonstrated the proofs for the third objective of this study using the values of R and R square demonstrated the rates at which the relationship between two variables is established. The R value indicated the rate at which two variables correlated which is supported by the R square indicating the total variation between the variables. The R value was estimated to 0.493 indicating a positive relationship between the variables. The R square demonstrated a value of 0.243 or estimated to 24.3% indicating the total variation at which government policies, stability and support of hydropower plant projects and success of hydropower project affect each other. Accordingly, there is a relationship existing

between Government policies, stability and support of hydropower plant project and success of the hydropower project and the relationship can be explained.

6. Conclusions and recommendation

17) 6.1. Effect of Environmental assessment project success of hydropower plant in Rwanda

The table no.16 demonstrate the beta= 0.397 with the t value of 2.333 and the p value of 0. 021.Since the p value is less than 0.05, researcher rejected the null hypothesis and considered it alternate. There is a strong positive relationship between environmental assessment project and success of hydropower project. As per table no.17, chi-square test for the environmental assessment is presented. The test indicated the asymptotic sig. value (2-sided) with the Pearson value for the environmental assessment estimated at 0.835. This p value demonstrated that the p value exhibiting a high strong and positive relationship linking two variables. Therefore, environmental assessment contributes to the improvement of success of hydropower project in Rwanda. Similarly, the table no.21 projected that the changes on community structure and dynamics of hydropower plant causes an increase of 0.341 (34.1%) of the success of hydropower project. The ration of beta modal results for the t value expressed t=2.66 concluding that the probability value is significant on success of hydropower project noting that sig.=0.009. In a nutshell, the researcher has rejected the null hypothesis and considered its alternate. In fact, Community structure and dynamics has positive influence on success of hydropower project.

18) 6.2 Effect of Community Structure and Dynamics of hydropower plant project on success of hydropower project in Rwanda

The table no.16 shows that beta= 0.341 with the t value of 2.668 as the p value was 0.009. Since the p value is less than 0.05. Therefore, researcher rejected the null hypothesis and considered it alternate. There is a strong positive relationship between community structure of hydropower plant project and success of hydropower project. According to the table no.18, chi-square test for the community structure is projected. The test indicated the asymptotic sig. value (2-sided) which has shown the Pearson value for the environmental assessment estimated at 0.865. According to the table no.21, the changes on community structure and dynamics of hydropower plant project causes the increase of 0.341 (34.1%) of the success of hydropower project. The ration of beta modal results for the t value expressed t=2.66 hence the probability value is significant on success of hydropower project noting that sig.=0.009. Carefully, the researcher has rejected the null hypothesis and considered its alternate. With this in mind, community structure and dynamics has positive influence on success of hydropower project.

19) 6.3. Effect of Government policies, stability and support on success of hydropower project in Rwanda

The table no.16 has shown beta= 0.478 with the t value of 4.543 as the p value was 0.000 which is less than 0.05. Therefore, researcher rejected the null hypothesis and considered it alternate. There is a strong positive relationship between government policies, stability and support on success of hydropower project. The chi-square test in the table no.19 indicated the results for the government policies, stability and support. The test indicated the asymptotic sig. value (2-sided) which has shown the p value or Pearson value for the Government policies, stability and support estimated at 0.835. While concluding, environmental assessment contributes to the improvement of success of hydropower project in Rwanda. According to the table no.21, the changes on government policies, stability and support of hydropower plant project causes the increase of 0.478 (47.80%) of the success of hydropower project. The ration of beta modal results for the t value expressed t=4.54 hence the probability value is significant on success of hydropower project noting that sig.=0.000. All things considered, the researcher has rejected the null hypothesis and considered its alternate confirming that government policies, stability and support of hydropower plant project has positive effect on success of hydropower project.

5.4. Recommendations

Due to a remarkable role that hydropower plants have demonstrated in boosting the social standards of people, there is a need in putting continuations efforts for both private and public sectors and

encourage individual to take care of the existing energy.

There is a need in encouraging projects proposals reflecting on environmental assessment and projects funding strategies should be renewed. Although a higher percentage of sources that product hydropower and other related power have already discussed, a small percentage need to be discovered and this can be applicable once the initiative in exploring the availability of energy expansion and proposals ca be a great start. One of the most important purpose that proposals contribute to the decision makers include easy projected outcomes.

Depending on past experiences, different types of and sources of hydropower-based energy including watersheds, rivers, and electric power plants which have been discovered but which all abide by the projects proposed form individuals and organizations in general.

Both public and private institutions should work toward improving the level of technology that is used in producing hydropower-based energy. Since this type of energy requires a flexible form of technology, there is a need in investing in capacity of water amounts and run of rivers. However, the way water resources are treated can also reflect on the amount that is required to produce a certain amount of energy. This is a good consideration that the public should consider to prevent water pollutions so that the amount of water available in producing energy is always constant. Most of the times, the level of technology to convert the energy varies from region to region. It is not comfortable with only one station serving around the whole country which lead to shortage of power and sometimes destructions occur. Moving forward, too much emphasize should be put to the improvement of advanced technology.

Institutions need to make sure that there is an effective risk identification in maintaining the available power by putting constant efforts. The future of hydropower plants might be doubted on while there is a restriction put on youth that they should put their effort in inventing new technologies and sources of power that can alternate with the existing ones. Therefore, there is a need in involving young people in exploring other types of power and provide adequate trainings. This will strengthen and boost management of hydropower plants projects which can also be done through schools and universities.

5.5. Area of further research

Due to the importance that hydropower plants exhibit in promoting the well-fare of individuals and the public in general, some modifications and improvements are still needed to come up with effective means of maintaining the amount and the source of power in Rwanda. Therefore, I recommend that future studies should work on the following points:

- ✓ Future studies should be conducted to find out the effects of water shortage and rainfall distribution on hydropower plants energy production.
- ✓ To find out the effects of climatic instability water pollution on the production of sustainable energy in Rwanda.
- ✓ Referring to the population increase; future studies need to assess the effects of higher population increase on inadequate distribution of natural resources and electricity.

Conflict of interest

There is no conflict of interest

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Reference:

Abbasi, T. (2011). Small hydro and the environmental implications of its extensive utilization. Renewable and Sustainable Energy Reviews 15, p 2134-2143.

Abrate, T. (1999). Water availability and data availability. WMO policy and activity', in Enne,

Abson, D. &Termansen, M. (2011). Valuing ecosystem services in terms of ecological risks and returns. Conservation Biology, 25, p250-258.

AFDB (2013a). Rwanda Energy Sector: Review and Action Plan.

AFDB (2013b). Rwanda-Scaling up Energy Access Project.

Agarwal, & Bina. (2001). Participatory Exclusions, Community Forestry, and Gender: An Analysis for South Asia and a Conceptual Framework." World Development 29 (10): 1623–1648.

Agrawala, S., Raksakulthai, V., van Aalst, M., Larsen, P., Smith, J. & Reynolds, J. (2003). Development and climate change in Nepal: Focus on water resources and hydropower. Paris: Environment Directorate, Development Co-Operation Directorate of Nepal, Organisation for Economic Co-operation and Development.

Alam, S. (2013). Sediment data collection over a long-term period: essential for better sediment management at hydro projects. Addis Ababa: The International Journal on Hydropower and Dams.

Alavian, V., Qaddumi, H. M., Dickson, E., Diez, S. M., Danilenko, A. V., Hirji, R. F., ... &Blankespoor, B. (2009). Water and climate change: understanding the risks and making climate-smart investment decisions. Washington, DC: World Bank, 52911.

Arias, M., Cochrane, T., Lawrence, K., Killeen, T. & Farrell, T. (2011). Paying the forest for electricity: A modelling framework to market forest conservation as payment for ecosystem services benefiting hydropower generation, Environmental Conservation, Volume 38, Issue 4.

Arnell, N. (1996). Global warming, river flows and water resources. Chichester, UK: Wiley.

Baanabe, J. (2008). Large scale hydropower, renewable energy adaptation and climate change and energy security in the East and Horn of Africa. HBF.

Bacon, R., Besant-Jones, J. &Heirarian, J. (1996). Estimating construction costs and schedules: experience with power generation projects in developing countries. Technical Paper 325. Washington, D. C.: World Bank.

Bailey, P. (2014). Leisure and class in Victorian England: Rational recreation and the contest for control, 1830-1885. Routledge.

Barry, M. L., Steyn, H., and Brent, A. (2011). Selection of renewable energy technologies for Africa: eight case studies in Rwanda, Tanzania and Malawi. Renew. Ener. 36, 2845–2852. doi: 10.1016/j.renene.2011.04.016

Bartle, A. (2002). Hydropower potential and development activities', Energy Policy 30, p1231-1239.

Bayeh, &Endalcachew. (2015). Human Rights in Ethiopia: An Assessment on the Law and Practice of Women's Rights. Humanities and Social Sciences 3 (2): 83–87.

Bayeh, Endalcachew. (2016). The Role of Empowering Women and Achieving Gender Equality to the Sustainable Development of Ethiopia. Pacific Science Review B: Humanities and Social Sciences 2 (1): 37–42.

Beaty, H. W. (2000). Electrochemistry and Electrometallurgy, in Standard Handbook for Electrical Engineers, 14th edn., eds G. D. Fink, and H. W. Beaty (McGraw-Hill), 24-2–24-38.

Becker, G. S. (1994). Human capital revisited. In Human Capital: A Theoretical and Empirical Analysis with Special Reference to Education, Third Edition (pp. 15-28). The University of Chicago Press.

Bensch, G., Kluve, J., & Peters, J. (2011). Impacts of rural electrification in Rwanda. J. Dev. Effect. 3, 567–588. doi: 10.1080/19439342.2011.621025

Bernard, J. T. (1989). A Ricardian theory of hydroelectric power development: some Canadian evidence. Canadian Journal of Economics, 328-339.

Bickerstaff, Karen, Walker, &Bulkeley, H. (2013). Energy Justice in a Changing Climate: Social Equity and Low-Carbon Energy. London: Zed Books Ltd.

Bimenyimana, S., Asemota, G. N., & Li, L. (2018). The state of the power sector in Rwanda: a progressive sector with ambitious targets. Frontiers in Energy Research, 6, 68.

Brew-Hammond, A. (2010). Energy access in Africa: challenges ahead. Energy Policy 38, 2291–2301. doi: 10.1016/j.enpol.2009.12.016 CR (Construction Review Online) (2017). Rwanda Launches First Peat-Fired

Brokensha, D. & Scudder, T. (1968). Hydropower plants in Africa: An Interdisciplinary Study of Man-made Lakes in Africa. (pp. 20-62). London: Frank Cass and Company Limited.

Cecelski, E. (2006). From the Millennium Development Goals towards a gender-sensitive energy policy research and practice: Empirical evidence and case studies. Collaborative Research Group on Gender and Energy, Netherlands.

Cernea, M. M. (1997). The risks and reconstruction model for resettling displaced populations. World development, 25(10), 1569-1587.

Cernea, M. M. (2000). Risks, safeguards and reconstruction: A model for population displacement and resettlement. Economic and Political Weekly, 3659-3678.

Cernea, M. M. (2003). For a new economics of resettlement: a sociological critique of the compensation principle. International social science journal, 55(175), 37-45.

Chirenje, Leonard I., Richard A. Giliba, and Emmanuel B. &Musamba. (2013). Local Communities' Participation in Decision-Making Processes through Planning and Budgeting in African Countries. Chinese Journal of Population Resources and Environment 11 (1): 10–16.

Clancy, Joy, S., Tanja Winther, Margaret NjiramboMatinga, &Oparaocha, S. (2011). Gender Equity in Access to and Benefits from Modern Energy and Improved Energy technologies. World Development Report, 2012.

Cornwall, A. (2008). Unpacking participation: Models, Meanings and Practices. Community Development Journal 43 (3): 269–283.

Creswell, J. W. (2007). Qualitative Inquiry and research design choosing among five approaches. (2nd Ed). Thousand Oaks, CA: Sage Publications.

De Vaus, D. A. (2014). Surveys in Social Research. (6th ed). Australia: UCL Press.

Del Rio, P., &Burguillo, M. (2009). An empirical analysis of the impact of renewable energy deployment on local sustainability. Renewable and Sustainable Energy Reviews, 13(6-7), 1314-1325.

Demeke, MemarAyalew, & Solomon, G. (2015). The Millennium Development Goals and the Status of Gender Disparity in Ethiopia: Achievements and Challenges. African Journal of Governance and Development 4 (1): 38–58.

Devine-Wright, P., Batel, S., Aas, O., Sovacool, B., Labelle, M. C., & Ruud, A. (2017). A conceptual framework for understanding the social acceptance of energy infrastructure: Insights from energy storage. Energy Policy, 107, 27-31.

Dryden, I. G. C. (1982). The Efficient Use of Energy. 2nd edn. London: Butterworth

ECA (2014). Energy Access and Security in Eastern Africa-Status and Enhancement

EDCL. (2018b). Electricity Access in Rwanda Quadrupled in the Last 7 Years as More Households Get Connected.

EUCL (2018). Incentives to Investors. Energy Utility Corporation Limited.

European Small hydropower Association (2004). Environmental group, Reserved flow, Short critical review of the methods of calculation. ESHA

Federal Democratic Republic of Ethiopia (FDRE). (2017). National Electrification Program

Fletcher, A. J. (2017). Applying Critical Realism in Qualitative Research: Methodology Meets Method. International Journal of Social Research Methodology 20 (2): 181–194.

Gallagher, M., P. Action, &Wykes , S. (2014). Civil Society Participation in the Sustainable Energy for All Initiative. In Practical Action Publishing Limited.

Gay-Antaki, & Miriam. (2016). Now We Have Equality: A Feminist Political Ecology

Analysis of Carbon Markets in Oaxaca, Mexico. Journal of Latin American Geography 15 (3): 49–66.

Geleta, &Esayas B. (2014). The Politics of Identity and Methodology in African Development

Girmay, Y. (2006). Assessing the Environmental Impacts of a Hydropower Project: The case of Akosombo / Kpong Hydropower plants in Ghana Assessing the Environmental Impacts of a Hydropower Project : The case of Akosombo / Kpong Hydropower plants in Ghana.

GIZ. (2011). Draft: Ererte Micro Hydropower Plant Handing Over". Unpublished Internal Document.

GIZ. (2017a). Energising Development Partnership – En Dev. Country Project Ethiopia."

Gollwitzer, L., D. Ockwell, B. Muok, A. E., &Ahlborg, H. (2018). Rethinking the Sustainability and Institutional Governance of Electricity Access and Mini-Grids: Electricity as a Common Pool Resource." Energy Research & Social Science 39: 152–161.

Gross, & Catherine. (2007). Community Perspectives of Wind Energy in Australia: The Application of a Justice and Community Fairness Framework to Increase Social Acceptance." Energy Policy 35 (5): 2727–2736.

Guest, G., A. Bunce, & Johnson, L. (2006). How Many Interviews Are Enough? An Experiment with Data Saturation and Variability." Field Methods 18 (1): 59–82.

Hakizimana, J. D. K., and Kim, H.-T. (2016). Peat briquette as an alternative to cooking fuel: a techno-economic viabililty assessment in Rwanda. Energy 102, 453–464. doi: 10.1016/j.energy.2016.02.073

Haskamp, Sandra, &Makonne, K. (2010). Baseline Survey: Small Hydro Power Access to Modern Energy Services in Ethiopia (AMES-E).

Heffron, Raphael J., McCauley,D., &Sovacool, B.K. (2015). Resolving Society's Energy Trilemma Through the Energy Justice Metric." Energy Policy 87: 168–176.

Hershowitz, A. (2008). A solid foundation: Belize's chalillo dam and environmental Decision making. Ecology Law Quarterly, 35(1), 73-105.

Hildyard, N. (2008). Dam on the rocks: The flawed economics of large hydroelectric dams The Corner House Briefing. Dorset, United Kingdom: The Corner House.

Hossain, M. A. (n.d.). Tipaimukh Hydropower plant of India: Probable Disaster for Bangladesh, 1–23.

Huesca-Pérez, Elena, M., Sheinbaum-Pardo, C., &Köppel, J. (2016). Social Implications of Siting Wind Energy in a Disadvantaged Region: The Case of the Isthmus of Tehuantepec, Mexico." Renewable and Sustainable Energy Reviews 58: 952–965.

I nternational River Network (2004). A Critique of the World Bank's Country Assistance Strategy for India, prepared by Ann Kathrin Schneider, International Rivers Network.

Islar, M., Brogaard, S., & Lemberg-Pedersen, M. (2017). Feasibility of Energy Justice: Exploring National and Local Efforts for Energy Development in Nepal. Energy Policy 105: 668–676. doi:10.1016/j.enpol.2017.03.004.

Kassa, S. (2015). Challenges and Opportunities of Women Political Participation in Ethiopia. Journal of Global Economics 3 (4): 1–7.

Kolodinksy, J. (2008). Sampling. Paper presented at the University of Vermont, Burlington, VT.

Kumar, N., &Quisumbing, A. R. (2015). Policy Reform Toward Gender Equality in Ethiopia: Little by Little the Egg Begins to Walk. World Development 67: 406–423.

Kuznets, S., & Chairman Universities-National Bureau Committee. (1949). Foreword, table of contents. In Problems in the Study of Economic Growth (pp. 3-0). NBER.

Lodico, M. G., Spaulding, D. T., &Voegtle, K. H. (2010). Methods in educational research: From theory to practice (Vol. 28). John Wiley & Sons.

Maingi, J. K., & Marsh, S. E. (2002). Quantifying hydrologic impacts following hydropower plant construction along the Tana River, Kenya. Journal of Arid Environments, 50(1), 53–79. doi:10.1006/jare.2000.0860

Mayring, P. (2000). Qualitative Content Analysis; Forum Qualitative Sozialforschung / Forum: Qualitative Social Research, Vol 1, No 2 (2000)

McCauley, D. A., Heffron, H., Stephan, R. J., & Jenkins, K. (2013). Advancing Energy Justice: The Triumvirate of Tenets. International Energy Law Review 32 (3): 107–110.

Meder, K. (2011). Application of Environment Assessment Related to GIZ ECO Micro Hydropower Plants in the Sidam Zone/Ethiopia." [Masther thesis]. University of Heidelberg, Heidelberg,Germany.

Ngozwana, N. (2017). Ethical dilemma in qualitative research methodology: Research's reflections. International Journal of Educational methodology. Volume 4,issyue1,19-28.

Ngwokabuenui, P. Y. (2013). Principals' attitudes toward the inclusion of students with disabilities in the general education setting: the case of public secondary and high schools in the north west region of Cameroon. Research Journal of Social Sciences & Management, 2(10), 7-23.

R. S. Odingo (1979). Summary, Conclusions and Recommendations. Ecological Bulletins No. 29, An African Dam: Ecological Survey of the Kamburu/Gtaru, Hydro-Electric Dam Area, Kenya. pp. 173-182

Peter, G. & Pottier, D. (2001). Desertification convention: Data and information requirements for interdisciplinary research. Proceedings of the international workshop held in Alghero, Italy, 9 to 11 October 1999. Luxembourg: Office for Official Publications of the European Communities.

Polkinghorne, D. E. (2005). Language and meaning: Data collection in qualitative research. Journal of counseling psychology, 52(2), 137-145.

Sapkota, N. (2000). Using the risks and reconstruction model in resettlement planning: Kali Gandaki Dam, Nepal. The Eastern Anthropologist, 53(1-2), 201-212.

Savin-Baden, M., & Major, C. H. (2013). Qualitative research: The essential guide to theory and practice.

Schultz, T. W. (1961). Investment in human capital. The American economic review, 1-17.

Snoussi, M. L., Kitheka, J., Shaghude, Y., Kane, A., Arthurton, R., Tissier, M., &Virji, H. (2007). Downstream and coastal impacts of damming and water abstraction in Africa. Environmental Management, 39, 587–600.

Sovacool, B. K., & Dworkin, M. H. (2015). Energy Justice: Conceptual Insights and Practical Applications. Applied Energy 142: 435–444.

Sovacool, B. K., Mukherjee, I., Drupady, I. M., & D'Agostino, A. L. (2011). Evaluating energy security performance from 1990 to 2010 for eighteen countries. Energy, 36(10), 5846-5853.

Sovacool, B. K., S. Dhakal, O. Gippner, &Bambawale, M. J. (2011). "Halting Hydro: A Review of the Socio-Technical Barriers to Hydroelectric Power Plants in Nepal." Energy 36 (5): 3468–3476.

Standal, K., and Winther, T. (2016). Empowerment Through Energy? Impact of Electricity on Care Work Practices and Gender Relations. Forum for Development Studies 43 (1): 27–45.

Strydom, B. D. (2018). Ethical leadership across cultural value orientations. (Doctoral dissertation, University of Pretoria).

Sweetland, S. R. (1996). Human capital theory: Foundations of a field of inquiry. Review of educational research, 66(3), 341-359.

TeferiTessema, &Girum. (2017). Feasibility Study on Mini-hydroelectric Power Plant for Rural Electrification.Royal Institute of Worldwide Campus, Addis Ababa University.

Tigabu, D. G. (2016). Deforestation in Ethiopia: Causes, Impacts and Remedy." International Journal of Development Research 4 (2): 2321–9939.

UN Women. (2013). Advancing Gender Equality: Promising Practices. Case studies from the

UNDP. (2016). UNDP Support to the Implementation of Sustainable Development Goal

Wittwer, G. (2009). The Economic Impacts of a New Hydropower plant in South-East Queensland. Australian Economic Review, 42(1), 12–23. doi:10.1111/j.1467-8462.2009.00506.x

Workman, J. (2009). Dams Encyclopedia of Environmental Ethics and Philosophy. (Vol. 1, pp.197-200). Detroit: Macmillan Reference USA.

Yin, &Robert, K. (2011). Qualitative Research from Start to Finish. 1st ed.New York: Guilford Press.

Yuksel, I. (2009). Dams and hydropower for sustainable development. Energy Sources Part B

Economics Planning and Policy, 4(1), 100-110. doi: 10.1080/15567240701425808

Yuksel, I. (2009). Hydropower plants and hydropower for sustainable development. Energy Sources Part B-Economics Planning and Policy, 4(1), 100-110.

Zelenakova, M., Zvijakova, L., &Purcz, P. (2013). Small Hydropower Plant – Environmental Impact Assessment – Case Study, 3(4).

