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MASTER OF GEO-INFORMATION SCIENCE FOR ENVIRONMENT AND SUSTAINABLE DEVELOPMENT (MSc GIESD)

Kigali campus

Evaluation of Environmental Impact Assessment effectiveness in Rwanda

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Ref: 218014492

4th December 2023

DECLARATION

I state that this work titled **"Evaluation of Environmental Impact Assessment Effectiveness in Rwanda"** is my work, and it has not been submitted for any degree in any other higher learning institution, and that all the sources I have used have been indicated and acknowledged by complete references.

Signature……

MUTAVU Grace **Date……..**

APPROVAL

This is to certify that this work titled **"Evaluation of Environmental Impact Assessment Effectiveness in Rwanda"** is a study carried out by **MUTAVU Grace,** as part of requirements for the completion of the MSc in Geo-Information Science for Environment and sustainable Development (GI-ESD) at the School of Architecture and Built Environment (SABE), College of Science and Technology (CST), the University of Rwanda (UR).

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School of Architecture and Built Environment

DEDICATION

To

Almighty God

My mother and relatives

All my friends

Acknowledgment

I would like to thank my supervisor **Prof. KABERA Telesphore** for his great support, advice and encouragement, and all my lecturers who helped me to achieve this.

I would like also to thank my family and friends for their financial and moral support.

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ABBREVIATIONS

EIA	Environmental Impact Assessment
REMA	Rwanda Environmental Management Authority
RDB	Rwanda Development Board
MoE	Ministry of Environment
NGO	Non-Governmental Organization
SPSS	Statistical Package for the Social Sciences
NEPA	National Environmental Policy Act
GoR	Government of Rwanda
RAPEP	Rwanda Association of Professional Environmental practitioners
IAIA	International Association for Impact Assessment
LCA	Life Cycle Assessment
NIRS	National Institute of Statistics of Rwanda
GDP	Gross domestic products
SEA	Strategic Environmental Assessment
EMP	Environmental Management Plan

Abstract

EIA is widespread as an instrument to manage the environment and a debate to which extent it achieves its goals or purpose has been created. This was measured in terms of EIA effectiveness. This Thesis seeks to assess the current status of EIA effectiveness in Rwanda, identify people's perception and providing the recommendations to improve EIA practice effectiveness in Rwanda. Policy review, desk research methods and quantitative survey were used to study EIA process and to assess EIA practice. The views of certified EIA practitioners (80) in Rwanda and other considered groups from different competent institutions which include REMA, RDB, academia, NGOs and EIA developers (Project owners) were examined closely. Only 46.3% of the targeted groups responded the questionnaires. Data were captured and analyzed in the Software Package for Social Sciences (SPSS). The policy review showed that the EIA in Rwanda started in 2005 and like in many other developing countries the EIA implantation is still a challenge and there is a perception for the project owners that EIA is costly especially for mitigation measures. The main strength was seen in policy and legal framework, and the weakness was found to be the lack of monitoring, insufficient public participation and lack of professionalism for EIA practitioners. To contribute to a more sustainable development plan some recommendations were made, which include enforcement of the follow-up and monitoring, training for EIA practioners, increase of ownership among the EIA experts, and the improvement of collaboration and interaction between competent institution, EIA experts and project owners.

CHAPTER ONE: INTRODUCTION

1.1. Background

Over the past century the impact of human activities on the environment has increased rapidly because of high population pressure, technology development, agricultural and industrialization which cause a significant impact on the limitation of planet's capacity to supply the world's needs. (European Commision, 2007). Thus, EIA comes as a solution to identify and mitigate environmental problems caused by those activities.

The EIA method begun in the USA in 1969 under the National Environmental Policy Act (NEPA) and was adopted in 1985 (Glasson et al, 2005). However, Environmental Impact Assessment is widely used all over the world: 191 out of 193 Unite nations' members have the legislation concerning the use of EIA. Therefore, EIA looks to be a universally recognized tool for environmental management that is much used at the national and international levels and that is inserted also in national and international environmental law (Morgan et al, 2012).

In Africa up to 2009, forty-eight among fifty-four countries had ratified framework environmental law, and in 2009 twenty-four countries had EIA guidelines (Nugent, 2009). EIA has been a helpful tool for decision making for different organizations, institutions, banks, etc. Today, more than 100 countries, banks, and the international agencies oblige EIA for major projects or activities (Rebelo & Guerreiro, 2017).

EIA is defined as the simple way of assessing the effect of proposed activities that may considerably cause the environmental problem before making the decisions (Wood, 2003). However, the purpose of EIA is mostly to inform decision-makers and the public concerning the environmental effect of the proposed project before taking decisions and enhance decisions for environmental problems. Moreover, EIA is seen as the simple way of promoting and achieving sustainable development (Glasson et al, 1999).

Since 2005, Rwanda like other developing countries adopted an EIA as a tool to mitigate environmental challenges including, biodiversity loss, climate change, wetland drainage, soil loss, water degradation, and deforestation (REMA, 2006). However, It has been realized that the main threat to the environment in Rwanda is driven by increased population pressure which Affect the physical environment (GoR, 2007). This makes the depletion of natural resources which consequently causes the environmental effects, it is in this regard the Government of Rwanda adopted EIA and developed EIA guidelines as a tool to mitigate environmental impacts (REMA, 2006). However, EIA practice effectiveness is still a challenge in Rwanda like in other developing countries. Since EIA mergence, it has been increasing the interest of examining and questioning EIA effectiveness (Harmer, 2005).

However, in developing countries EIA effectiveness is a challenge due to lack of adequate EIA experts, lack of follow-up (Kosamu, 2011), Lack of data and inadequate EIA reports (Kamijo & Huang, 2016). In Rwanda, major challenges to EIA practice include lack of public participation and insufficient resources for EIA implementation (Marara et al., 2011) and an insufficient number of EIA decision-makers (Kabera, 2017).

Therefore, many studies on EIA effectiveness have been conducted in different countries but in Rwanda little information on EIA effectiveness is known. This study seeks to provide the current status of EIA Practice and its effectiveness in Rwanda, identifying people's perception and provide necessary information and recommendation to inform the planners and influencing decision-makers for sustaining the environmental protection.

1.2.Problem statement

Over the past century, natural resources are facing the problem of degradation due to human activities. If there are no measures taken to change the people's behavior toward the environment, these increasing pressures will cause the significant impact on the environmental capacity to supply the world's needs (economies), this is including, energy, sufficient water and other basic resources. (EuropeanCommision, 2007).

In Africa, the countries of Kenya, Tanzania, and Rwanda face major environmental problem including soil erosion, deforestation, depletion of natural resources, water pollution, and inadequate waste management (Marara et al., 2011). To overcome these challenges, many developing countries like Rwanda adopted and implemented EIA as a tool to enhance environmental protection and its sustainability (Gebreyesus & Sammy, 2017).

However, the question remains whether the EIA system and practice are applied effectively in developing countries. Kosamu (2011) stated that lack of sufficient EIA experts, follow-up and monitoring are still major challenges for EIA effectiveness in developing countries. However, without follow-up being completed the real effects are not considered (Harmer, 2005). According to Sadler (1996), follow-up of EIA is one of the most priorities for enhancing EIA effectiveness.

In addition to that lack of data and inadequate EIA reports lead to EIA ineffectiveness (Kamijo & Huang, 2016) while, the quality of the EIA Reports is incredibly necessary for good decision-making and the efficiency of EIA process . (Kamijo & Huang, 2016). In Rwanda public participation, insufficient resources for EIA implementation (Marara et al., 2011) and insufficient number of EIA decision-makers (Kabera, 2017) were identified as major challenges to EIA practice effectiveness.

The EIA process in Rwanda has the same limitations as in other developing countries where several EIA developers perceive it as a barrier (Munyazikwiye, 2011). Others found that it is a constraint in project development as cost and time-consuming. (Morgan et al., 2012). while EIA

can be a great benefit to them, as it can offer a structure to consider for implementing the project sustainably (Morgan et al., 2012). According to Nhamo (2016) EIA has become just a paper to secure a project development license, instead of the substantive tool in managing the environment in order to bring environmental advantages and sustainable environmental protection.

In Rwanda, each project that might have an environmental impact should be subjected to EIA in order to mitigate the environmental challenges (REMA, 2006), therefore the reports are produced with proposed mitigation measures but their effectiveness remain a problem and the little information on the status of EIA practice and its effectiveness in Rwanda is unknown. This should be linked to insufficient research on EIA status and EIA practice effectiveness. Therefore, this study aimed to find and provide the information to guide the EIA practioners, planners and decision-makers.

1.3. General Objective

The main objective of this study is to provide the current status of EIA effectiveness in Rwanda

1.4.**Specific objectives**.

1. To Investigate EIA system application in Rwanda
2. To evaluate EIA effectiveness in Rwanda
3. To identify people's perception of EIA in Rwanda.
4. To provide recommendations for the efficient EIA practice in Rwanda.

1.5.Research Questions

1. What are the status EIA practice and its effectiveness in Rwanda?
2. How do stakeholders and other people perceive EIA in Rwanda?
3. What are the recommendations that should be provided for an efficient EIA in Rwanda?

1.6. Hypothesis

1. EIA practice in Rwanda is not effective.
2. A combination of lack of EIA follow up and EIA professional experts are contributing to an EIA ineffective in Rwanda.
3. EIA developer has insufficiency knowledge on the importance of EIA
4. Public consultation and participation are sufficient.

1.7.Geographic Location of Rwanda

Rwanda is a small landlocked country located in central Africa with a population of 12 million in land surface of 26338km2. The population density is about 467 people per kilometer square (NIRS, 2017) and is bordered by Burundi, Democratic Republic of Congo, Tanzania, and Uganda and it lies some degrees on south of the equator. The capital, Kigali, is found close to the center of the Rwandese republic. (Figure1). Its population relies upon agricultural, industries; tourism, etc. according to NIRS (2017) GDP per capita is 729 USD.

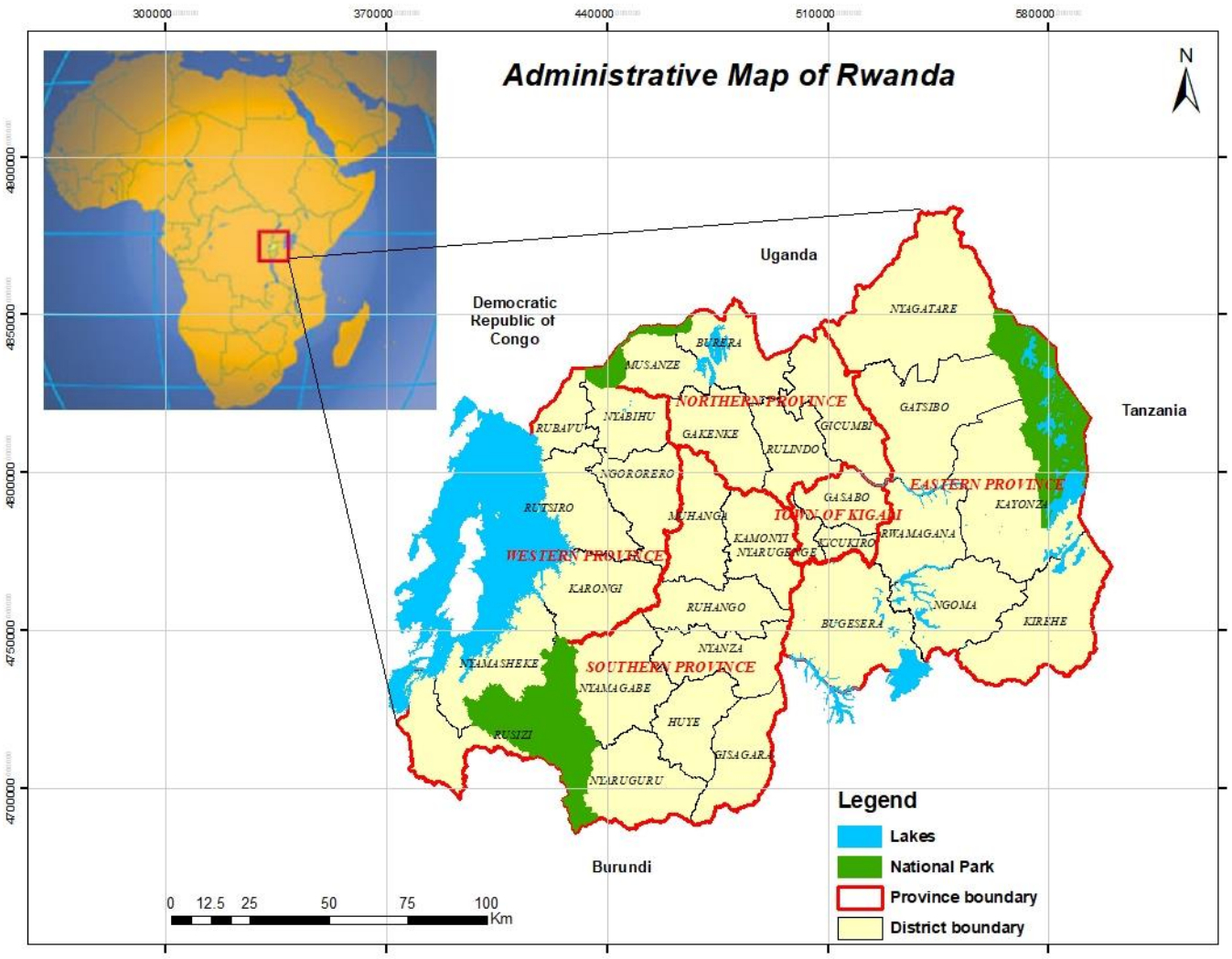

Figure 1: Geographical location of Rwanda

1.8.Significant of the research

Lack of adequate EIA experts, follow-up and monitoring, lack of data (published EIA reports), and inadequate EIA reports were mentioned as challenges for the EIA practice. Besides, public participation and insufficient resources for EIA implementation are also still a challenge in Rwanda (Marara et al, 2011). However, many studies on EIA have been conducted but little information is known on the EIA effectiveness. It is in this regard the evaluation of EIA effectiveness in Rwanda identified key challenges and gaps in Environmental management and providing the important information on the current status of EIA practice to inform the planners and decision makers.

However, this study aimed to explore the perception of people on EIA. Many reports on EIA were produced but the environmental problems are still happening, it is hypothesized that this is due to the insufficient knowledge of EIA developer on the importance of EIA. Moreover, they might have the perception that they need the EIA report to get a certificate for project implementation authorization. Therefore, they might implement their projects without considering the Environmental Management Plan and measures or alternatives given by experts. Thus, this study intended to provide the information of people's perception on EIA practice, which helps to enhance awareness among the EIA developer and other stakeholders.

Therefore, the recommendations were provided referring to the gaps or challenges identified to inform the planners and contributing to decision making on sustainable use and management of the environment.

CHAPTER TWO: LITERATURE REVIEW

2.1. Background

The Environmental Impact Assessment (EIA) was introduced in the early 70's, in the United States of America under the National Environmental Policy Act (NEPA) and was officially introduced in 1970 (Glasson et al, 1994). NEPA influenced the effective of EIA implementation in the USA. After successful implementation of EIA in the USA, the process was spread in many countries in Europe and Asia. In 1975, the Commission of the European Communities (CEC) initiated EIA research and issued the first draft in 1977 but the process was adopted from 1985. However,

developing countries such as Thailand and Columbia started an EIA system from 2007. (Glasson et al, 1994).

According to Nugent, up to 2009, 48 of 54 African countries had already ratified framework environmental law, while 75 percent of the countries had introduced detailed EIA regulations and 24 of them had published detailed guidelines for EIA implementation. (Nugent, 2009). EIA is now widely used (Morgan, 2012). Therefore, EIA is defined as a way of assessing the effect of proposed activities that will significantly affect the environment before the decision is made (wood, 2003).

Environmental Impact Assessment (EIA) is used as a global tool to prevent negative environmental impacts. Hence, EIA aims to ensure that environmental issues are taken into consideration during the planning phase of any development projects. Harmer 2005, further defines EIA as a tool used to identify the impacts of human activities on the environment, before identification and implementation of mitigation measures. This definition was then adopted by the European Commission in 2007.

Among other things EIA aims to gather and provide information to project stakeholders, including: decision makers, interested and affected parties. However, it is important to know if EIA is practiced effectively and understand how it is evaluated.

EIA effectiveness can be defined on how well the process works, to identify environmental issues and mitigates against environmental degradation. Sadler 1996, provided a framework to evaluate EIA effectiveness categorized in three measurements: procedural, substantive and transactive effectiveness.

Procedural effectiveness mainly focuses on compliance with procedures and expected good practices. This is a measure of how compliant the EIA process is against the set environmental policies and standards, guideline and procedures.

Substantive effectiveness is a measure of the EIA results related to the outcomes of EIA in terms of the set objectives; if the process produces the expected results. It is this category that assist to weigh the inclusion of environmental aspects in decision making and Sustainable Development.

However, (Bina, 2008) defines the substantives purpose as a recovery process of the main intent of the environmental impact assessment to promote Sustainable Development in policy making.

The third aspect is Transactive effectiveness, which is mainly focused on costs in terms of financial and time resources invested in delivering substantive goal (Sadler, 1996).

Baker & McLelland (2003) added the other aspect on the list developed by sadler1996, which is normative effectiveness that focused on normative goals. Thus, the context of society has a big impact on effectiveness that is based on stakeholder's perception (Nhamo, 2016). However, EIA evaluation as a process carries more weight when performed within geotechnical, cultural heritage and geo-political aspects of the countries in question.

EIA effectiveness is being discussed by many countries that have invested in effectiveness of Environmental Impact Assessment; and identifies the challenges to be resolved, aspects of effectiveness that includes: report quality, decision-making, efficient prediction, management of the impacts, monitoring and evaluation (Sadler, 1996). Both decision marking and EIA effectiveness are influenced by quality of the audit and reports (Kamijo and Huang, 2016). Most of the EIAR's submitted to the Asian Development Bank highlights that the process is weak in:

1. Assessment of Environmental Impacts
2. Analysis of mitigation methods
3. Economic analysis of environmental impacts, and
4. Inputs by interested and affected parties

Lack of implementation and enforcement is a big challenge in developing countries mainly in Africa and Asia; highlighted in late implementation, restricted public consultation and lack of data and lack of consideration of alternatives mainly influenced by funding and skills availability. For the system to function better EIA's have to be implemented in time, conduct broad public participation and provide relevant information on the proposed project World Bank 2006).

Despite developing countries that face the challenges of weak EIA practice, there are others countries experiences good EIA practice such as USA, Canada, Australia, and European Countries; where records of public participation are made available, other ways to minimize environmental impacts are considered and residual impacts are managed, (Li, 2008).

However, Gibson 2005 identifies the international best and worst case of EIA performance as follows:

Best-case scenario for EIA process

- It provides a good platform for investigation of impacts and an in-depth understanding of impacts and analysis of the effects of the planned activities.
- Helps in identification the feasible environmental method, with less environmental impacts.
- It impacts on projects methodology and environmental management plan (EMP) design by reviewing the environmental unreliable proposal and amending practical action.
- Enable public participation and review in scoping and presentation of the project.
- Encompasses all significant problems including cultural-heritage, geo-political, geotechnical and social risks.
- It informs formal approvals and establishes terms of reference (ToR) for project implementation
- Use customized techniques for mitigation measures which are site or project specific and lead to reliable prediction of environmental impacts. (Sadler 1996, Glasson et al. 2005).

Worst-case performance on the EIA process.

- Characterized by poor project cycle and eventually operates as a standalone process.
- Insufficient follow-up and lack of investigation on the project implementation.
- Lack of consideration of overall residual and inherent effects on the environment and people.
- Lack of public consultation and participation
- Poorly structured EIA reports
- Provide irrelevant information that does not aid in decision making
- Ineffective, time-consuming and costly.
- It lacks credibility and it inadequately devalues mitigation measures

However, Even if there are developed and some developing countries applying EIA with the best practice but still they have a long way to go in terms of incorporation of indirect impacts (Glasson et al. 2005). Though, both developed and developing countries have continued to improve, harmonize, and increase the coherence of EIA practice. (Li, 2008)

2.2. The purpose of EIA

As mentioned earlier, EIA is a process applied to minimize or prevent adverse environmental impacts of projects; dams, roads, stadiums, industrial complexes, airports, stations etc. (Glasson et al., 1999). Minimization or prevention of these adverse effects is required to meet the standards set-out in Sustainable Development. EIA process aims to address both long- and short-term objectives (Sadler, 1996). The short-term objective of EIA informs decision-makers in the decision-making process by providing information on the environmental impacts of proposed projects, while the long-term aim is the promotion of sustainable development by making sure that development does not degrade the environment and the wellbeing of communities who rely on them (Sadler, 1996). According to Sadler (1996), the immediate objectives are to:

- Ensure appropriate and efficient utilisation of natural resources;
- Improve the design of development proposals;
- Propose appropriate mitigation measures for potential impacts; and
- Aid decision makers in making informed decisions about the acceptability of the proposed development.

Was also pointed out the following as the long-term objectives of conducting an EIA:

- Protection of human health and well-being;
- Prevention of serious harm to the environment;
- Protection of valued resources and natural areas; and
- Enhancement of the social aspects of the project.

2.3. Sustainable development

Sustainable Development is a complex term and many meanings of the concept have been put forward. According to Fowke and Prasad (1996), more than eighty definitions of sustainable development exist. Sometimes the definitions are contradictory (Fowke and Prasad, 1996). However, as stated earlier, the widely used definition is the one put forward by the World Commission on Environment and Development (WCED). Sustainable development is attained where the existing generation meets their needs without denying future generations a chance to

satisfy their own needs (WCED, 1997). Similarly, Miller (2004) states that an environmentally sustainable society is one in which resource use satisfies the present generation's basic needs and avoids exhaustion of natural resources to ensure that current and future generations have access to the natural resources to meet their needs. These two definitions indicate that resource use needs to be done in a way that ensures the success of the present generation and at the same time ensures that future generations also have access to resources.

2.4. Measurement of EIA effectiveness

There has been a lot of debate concerning the measurement of EIA effectiveness in environmental management. It is challenging to identify a criterion to measure the effectiveness of an EIA process because; process consists of a number of stages (Wood, 2003). Some of additional challenges faced in the measurement of effectiveness is the way in which different stakeholders interpret EIA effectiveness (Cashmore *et al*., 2004). For example, some project proponents perceive EIA process an unnecessary but costly exercise in terms of both time and money. NGOs align it to the accountability of the decision makers (Cashmore *et al.,* 2004). Furthermore, assessment of EIA effectiveness requires access to information, more often than not this information is not available owing to a variety of reasons, also stress that little empirical data has been collected as a result of low levels of EIA follow-up, enforcement and compliance monitoring. This can be attributed to a lack of manpower (Fuggle and Rabie, 2009).

Despite these difficulties, efforts have been made to measure the effectiveness of an EIA process. Sadler (1996) points out that the effectiveness of an EIA process can be measured by the extent to which the EIA process achieves the goal of environmental protection. In addition, Cashmore *et al*. (2004), stress that EIA effectiveness can be measured by assessing the ability of an EIA to achieve its intended objectives, with minimum delay and at the least cost, and without bias and compliance with specific requirements. (Preez et al,1997) express concern over little reference to the procedure of mitigation at the post decision stage of a project. They propounded that this often leads to decision making based on the options perceived to be the most environmentally sound, and identification of mitigation measures in the absence of formal provision for implementation of recommendations. In an attempt to quantify the overall effectiveness of EIA, various frameworks

and review packages have been devised. The Lee and Colley review package (1992) is among the commonly used packages to measure the quality of EIAs.

2.5. EIA in Rwanda

The awareness of Environmental problems in Rwanda started from the colonial period, the conservation and protection of environment undertaken from different periods, for example, reforestation activities started from 1920, that initiatives continued where the Akagera National Park introduced in 1935. (GoR, 2003). However, the Environmental Impact Assessment started from 2005, where REMA was established under the Organic Law No.04/2005 of 08/04/2005 Article 64, to manage environmental challenges. (REMA, 2006). REMA was established to coordinate and oversee all aspects of environmental management for sustainable development. However, the principal function of REMA is to oversee the conduct of EIAs and take a decision on proposed development projects to be undertaken by both the public and private sectors. (REMA, 2006).

RDB was established by Organic law No.53/2008 as a specialized organ in charge of fast-tracking development activities and facilitating investors to meet environmental standards in the implementation of their projects. It in this regard, from 2009 all EIA applications started to be sent to RDB for review and certification and the number of EIA conducted has increased from 89 in 2009 to 407 in 2018 see (figure 2). However, the provision to undertake EIA for all projects that might have an impact on the environment became mandatory in May 2005(REMA, 2006). In addition to that Government of Rwanda established Ministerial Order no 001/2018 of 25/04/2018 determining the list of works, activities, and projects subject to an environmental impact assessment.(“Official Gazette n°15 of 15/04/2019,” 2019).

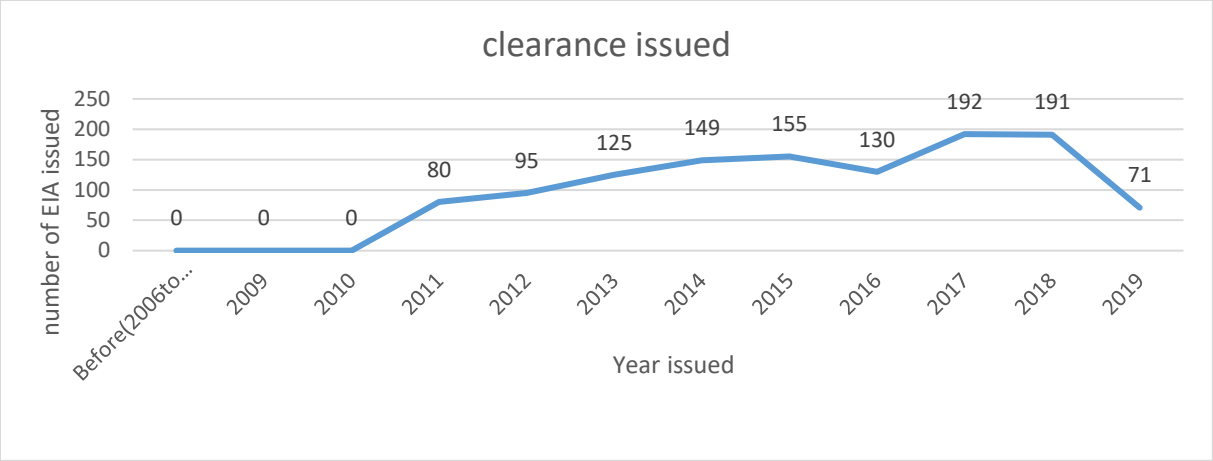

FIGURE 2: EIA CLEARANCE ISSUED FROM 2009-2019 (RDB, 2019)

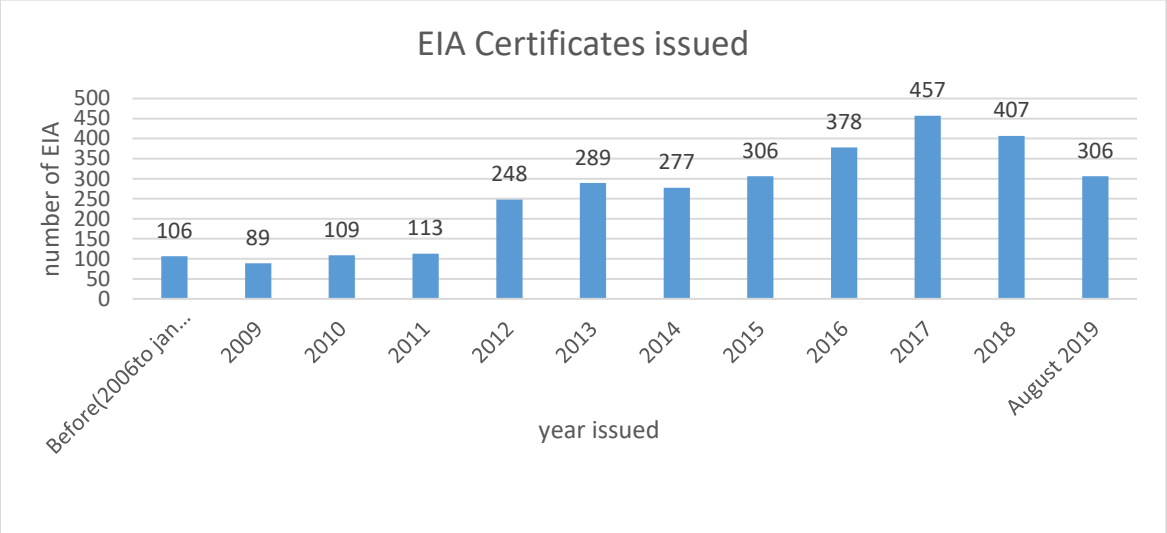

FIGURE 3: EIA CERTIFICATES ISSUED FROM 2009-2019 (RDB, 2019)

EIA process in Rwanda including four stages (figure 3): Environmental Impact Initiation phase, the Impact Study, the decision-making and authorization and environmental management and follow-up phase with the following steps, Project Application and Registration by REMA, Screening, Scoping and Terms of Reference, Environmental Impact Study, Report preparation and Monitoring. The stages of the EIA process have a significant importance in the procedural effectiveness. According to (Sadler, 1999) the EIA process plays the following role:

- The screening process plays a role in narrowing the application of EIA to the projects that may have significant adverse impacts on the environment.

- Scoping seeks out to find an early stage from all potential impacts of the projects and all alternatives to be addressed.
- Alternatives consideration seek to ensure that the proponent has considered other feasible approaches including project location, scales, processes, layouts, and operating conditions.
- Mitigation contains the introduction of measures to avoid, reduce, and compensate for any significant adverse impacts.
- Public consultation and participation seek to ensure the quality, comprehensiveness, and effectiveness of EIA.
- The relevant authority of EIS makes decisions on the proposed projects.
- Auditing and monitoring involving in the comparison of actual outcomes with predicted outcomes and can be used to evaluate the quality of prediction and effectiveness of mitigation measures.

However, the EIA process in Rwanda has the same limitations as other developing countries, where EIA developers perceive EIA as a barrier. (Munyazikwiye, 2011). Many EIA developers perceive it as another cost and time-consuming constraint on project development but EIA can be a great benefit to them, as it can offer a structure to consider for implementing the project sustainably(Morgan et al., 2012).

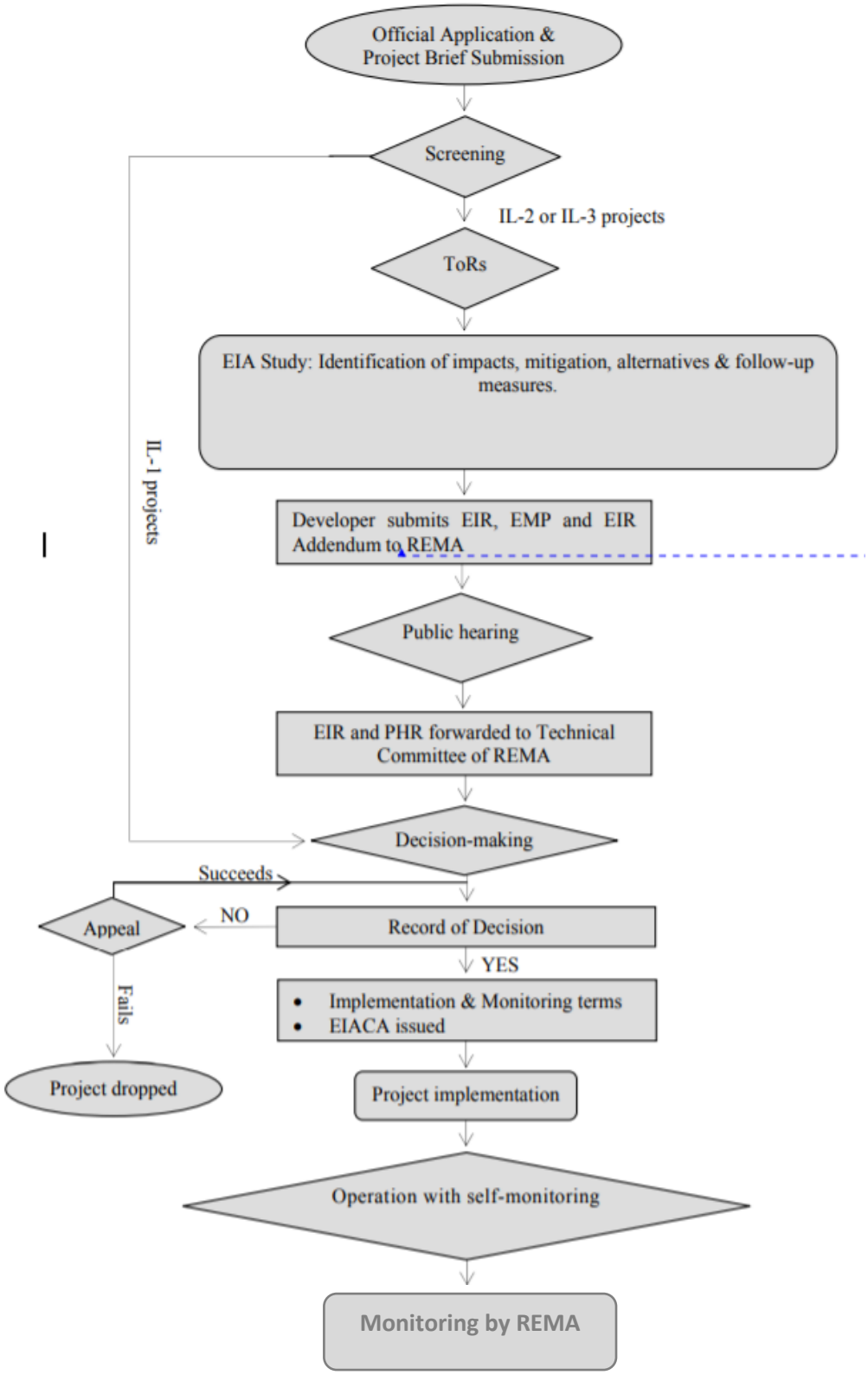

FIGURE 4: SUMMARY OF EIA PROCESS IN RWANDA. (REMA, 2006).

CHAPTER THREE: METHODOLOGY

This section aimed to describe the methodology that was used in this study. It describes the techniques used, data collection tools and statistical procedures for data analysis.

3.1. Material and methods

This study focused on the review of certified EIAs of the whole country conducted from 2009 to 2019, since EIA application started to be reviewed and certified by RDB, this interval was chosen for the reason that from 2009 the EIA application started to be increased compared to the previous years. In additional, the documents for reviewing were easily accessible from RDB. To meet the objectives, the primary and secondary data were used. However, to acquire information, field visits and interviews were conducted from the competent institutions and other agencies related to environmental protection and natural resources in Rwanda. Those include REMA that is in charge for coordinating and overseeing all aspects of environmental management and regulation for sustainable development (REMA, 2006), RDB that is responsible for EIA certification, NGO'S, project owner and academia.

The research questionnaire was designed referring to the one used by Zvijáková et al (2014) who conducted similar research in Slovakia. For this research, closed and open-ended questions were used. In the case of open-ended questions, the questionnaires were shared to 110 respondents including 80 from Rwanda Association of Professional Environmental practitioners (RAPEP) members who are qualified to conduct EIA in Rwanda (the list of Practitioners used was 2018-2019) and received questionnaires via email. Other targeted groups are five competent staffs from each of the following public originations dealing with EIA: REMA, RDB, NGOs, Academia and 10 from EIA developers (the project owner) including LUNA smelter factory, Ngali Mining, small scale mining projects and construction projects.

All participants were provided with a study information sheet and provided written informed consent prior to responding questionnaire. Twenty questions were developed to meet three objectives including the status of EIA practice effectiveness, people's perception of EIA in Rwanda and recommendations for improvement (see appendix).

Secondary data were collected from articles in different peer reviewed journals (these include Environmental Impact Assessment Review-EIA); Impact assessment and project appraisal and the international journal of life cycle assessment-LCA) and reports (published and unpublished). I order to use current information, articles and reports produced at least five (5) years ago have been considered.

Field survey was conducted on site of Ngororero mine site of Tetero cell, Kavumu Sector; was taken as a case study of the EIA implementation, (see appendices 1) referring to the statistical data from Rwanda Mining Petroleum and Gaz Board, this site is among the biggest mining project in Western province of Rwanda, which is large scale mining. However, Ngororero is known to have environmental problems due to mining activities carried in that area (Ngororero, 2013). Generally, mining is among the top factors of the environmental degradation due to its activities from exploration to exploitation,

During the site visit, field observation, record, photos and the interview with the key person in the project was made. This field visit was made to have ground information on the status of EIA practice and the site was chosen because it is a big mining and expecting to implement the mitigation measures so if a big project implements the small can follow.

Excel and SPSS package were used for statistical analysis, SPSS is essentially used to comprehend and interpret the results of research; the package allows you to get statistics starting from a simple descriptive numbers to complex analyses of variable matrices (Arkkelin, 2014). The data were plotted in histograms, scatter plots, charts, and tables to get the statistical data on the current practice of EIA and its effectiveness in Rwanda and the perception of people on EIA as well.

CHAPTER FOUR: RESULT AND DISCUSSION

4.1. Analysis of the review questionnaire data

The analysis of questionnaire responses underlined the perception of EIA challenges, weakness, and strength of current EIA practice in Rwanda. Out of the 110 questionnaires sent to different institutions includes EIA Experts, NGOs, EIA developers, academia and other competent institutions, 51 were completed and responded to the questions. This makes the respondent rate of 46.3%. The table 1 below summarizes the number of respondents and their respective institutions.

TABLE 1: NUMBER OF RESPONDENT PER INSTITUTION

Institutions	Number of respondents received questionnaires	Number of respondents completed the questionnaires
EIA practitioners (RAPEP members)	80	36
REMA	5	2
RDB	5	2
NGOs	5	2
EIA developers	10	7
Academia	5	2
Total	110	51

The questionnaire was categorized into 3 categories including self-introduction and education background, EIA legislation and EIA practice in Rwanda.

4.1.1. Respondent's Background

To discuss and analyze the background and skills level of the respondents, this section presents the results of the education background of the respondents. Twenty-nine percent of the questionnaire respondents have a bachelor degree, seventy-four percent master's holder, and eight percent PhD holders (see figure 6). As the majority of the targeted people are the EIA experts or

practitioners, these statistics shows that EIA is conducted with the educated people that should have a positive impact on the quality of the EIA Reports which can be reliable in decision-making.

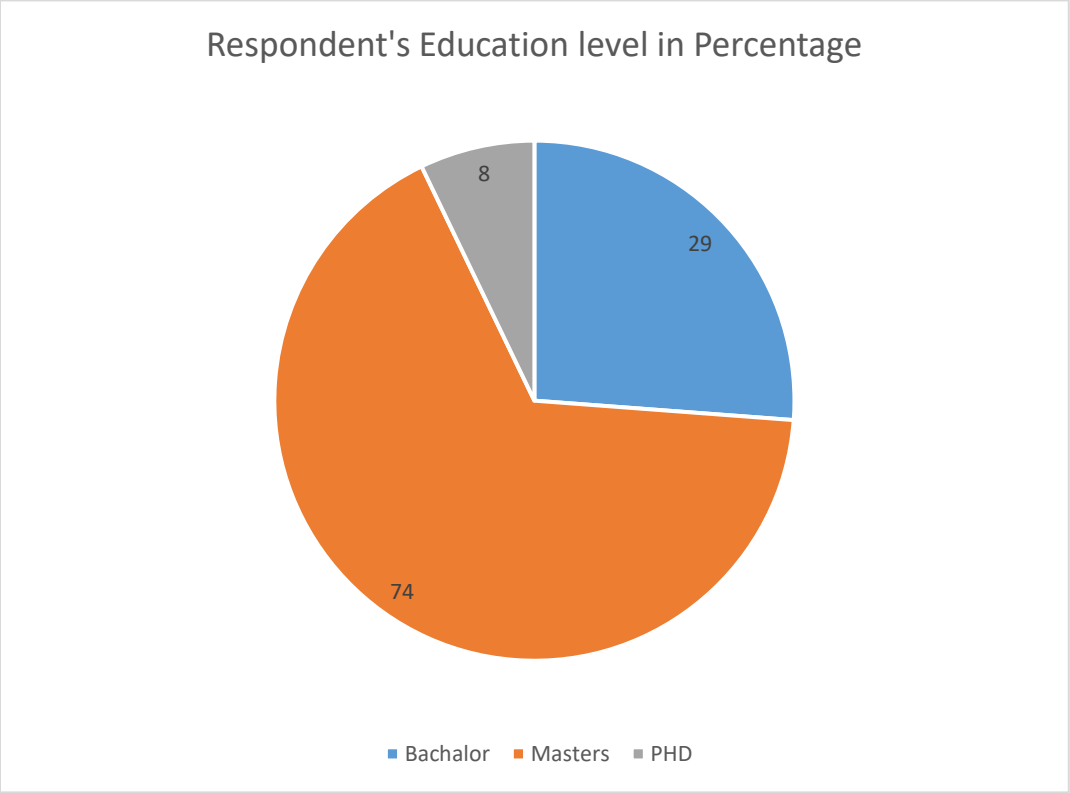

Figure 5: Level of education of EIA Experts

4.1.2. EIA expert's experience

This section shows the experience level of EIA practitioners in Rwanda. The survey found out that 18% of the practitioners have been working in the EIA field for 0-3 years, while 24% of practitioners have 3-5 years' experience, 12% for 5-7 years, 30% for 7-10 and 15% have more 10 years industry experience (figure 7). The survey found that the big number of surveyed respondents have experience between 3 and 5 years in conducting an EIA. This would have an important impact on the good practice and effectiveness of EIA in Rwanda when it is being conducted by experienced individuals.

Figure 6: Experience of EIA experts in Rwanda

The Respondents were also asked on the number of EIAs in which they have been involved in the last three Years. (figure 8) shows that 50% of the respondents had been involved in more than 15% EIAs, while 12% conducted EIA ranging from one to five and 38% had been involved in one to five EIA in the last three years.

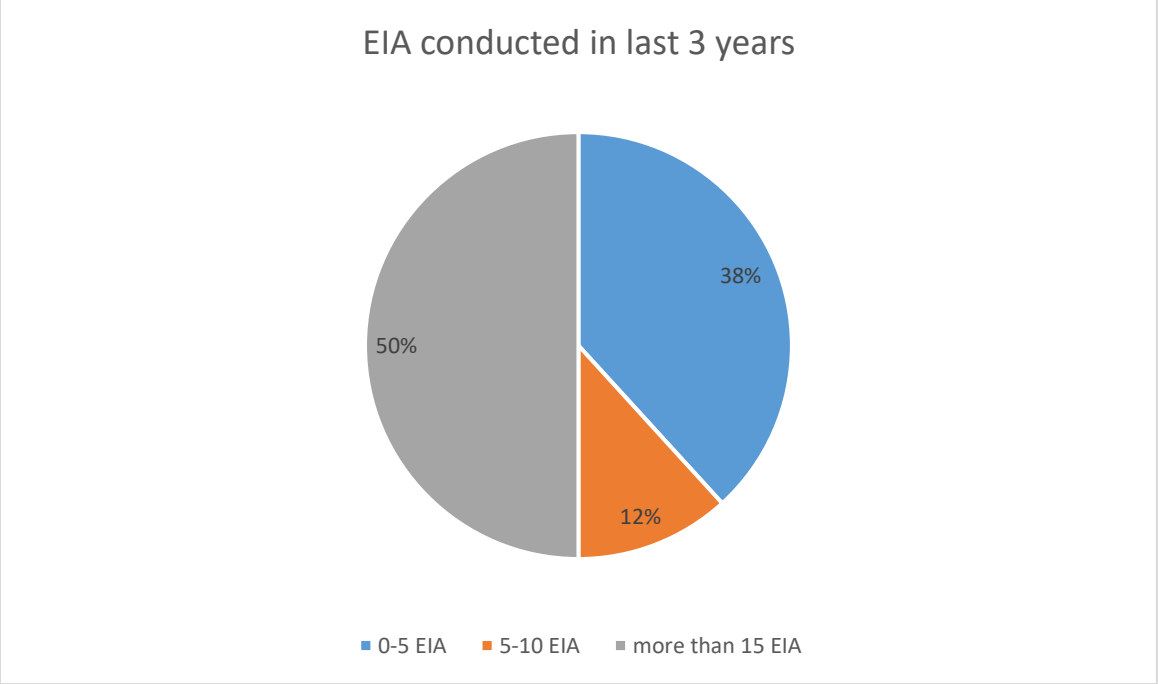

Figure 7: EIA conducted in last 3 years

4.1.3. The sector of experience.

The respondents were asked about sectors in which they have got an experience of EIA preparation. The majority of respondents stated that seventy percent have the experience in conducting EIA in construction. This confirmed by the statistical data from RDB, 2019 (unpublished data) shows that from 2016 to 2019, construction and mining projects have the largest number of projects subjected to EIA certification or clearance, clearance are given the projects that do not require full EIA (table 2& 3).

TABLE 2: CERTIFIED EIA PER PROJECT NATURE FROM 2016 TO 2019 (RDB, 2019)

No	Project Nature	Percentage (%)
1.	Agriculture forestry and fishing	13.8
2.	construction	51.20
3.	Manufacturing	3.70
4.	Mining and quarrying	15.83
5.	Transportation and storage	2.95
6.	Water supply, sewage, waste management, and remediation	3.29
7.	other	9.18

TABLE 3: EIA CLEARANCE PER PROJECT NATURE FROM 2016 TO 2019 (RDB, 2019)

No	Project Nature	Percentage (%)
1	Agriculture forestry and fishing	12.33
2	Construction	45.66
3	Electricity, gas, steam and air condition	9.63
4	Information and communication	11.18
5	Manufacturing	2.89
6	Other service activities	3.85
7	Water supply, Sewerage, Waste management	3.85
8	Others	10.60

However, Rwanda has emphasized and continues to invest in infrastructure in order to boost the development of the country, Some of those infrastructures includes the construction of roads, schools, hospitals, residential houses, commercial houses, hotels etc. This is confirmed by the RDB where stated that a tenth of Rwanda's annual budget is dedicated in transport (Roads, rail, water transport) and other different infrastructure (rdb, 2019), so this might be the reason why EIA certificate subjected to the construction projects are very high (fifty percent) compared to other sectors. Mining is also the second to the construction to be subjected with high number of EIA certification this is showed by the statistics of RDB where in 2017 mining was the second largest export earner on economy of Rwanda and generated about $373.4 million (rdb,2019)

However, all of those projects can harm the environment, so EIA is a key tool to mitigate the impact and enhance environmental protection. Therefore, to have a big number of EIA experts experienced in the construction (68%), agricultural (30%), mining (30%), and others (see figure 9). This can have a significant impact on environmental management and sustainable development.

Figure 8: Sector of EIA expert's experience

4.1.4. The involvement of EIA practitioners in the EIA process of Rwanda.

The respondents were asked the stages of the EIA process in which they are mainly involved in and the majority showed that forty-five percent involved in screening, this stage has an important role to narrow the application of EIA to the projects that may have significant environmental impacts. Thirty-one percent involved in EIA report preparation while Twenty two percent involved in EIA study (identification of impact, mitigation measures, and alternatives).

Twenty-eight percent of respondents stated that are involved in the Environmental Management Plan. It shows number of people involved in EMP is low and it is an important stage in EIA process as it contains all mitigation measures to prevent or minimize the adverse environmental impacts resulting from the project's activities and environmental monitoring plan as well. Moreover, the importance of mitigation measures is to minimize, avoid or compensate for the predicted adverse of project's impact. (Morris& Riki 2009).

However, Twenty percent involved in monitoring, this was seen in a literature review that in developing countries there is inadequate monitoring for the project implantation which can affects the EIA effectiveness. Kosamu (2011) Yet, without follow-up being completed the real effects are not considered. (Harmer, 2005). According to Sadler (1996), EIA follow-up is one of the most priorities for enhancing the effectiveness of EIA.

Fourteen percent involved in a public hearing. This was expected since it was seen that there are insufficient consultation and public participation. (Marara, 2011) This might have a significant impact on the EIA effectiveness in Rwanda because public participation in the EIA process has the importance of providing information that helps in decision-making. Therefore, when decisions are made with no public participation, the decisions can be questionable.

4.1.5. Specialization of EIA expert

EIA experts are specialized in the different environmental components when undertaking an EIA (Figure 10). The majority of respondents sixty nine percent are mostly involved in construction. This was expected since infrastructure (construction) is among the priorities to boost the

development of the country and their activities can destroy the environment, so it requires many specialists to provide their input to minimize and prevent the environment from the adverse impacts of development projects. However, this was shown by the statistical data of projects that were certified with an EIA conducted from 2016 to 2019 (see table 2&3) where the highest number of certified EIA is construction with fifty-one percent, mining and querying sixteen percent, agriculture fourteen percent, waste management three percent and transportation Two percent.

Up to sixty-six percent stated that they are specialized in waste management; this would have a good impact on waste management in Rwanda since it is an issue in both urban and rural areas. However, waste management was made as one of the priority areas in Rwanda to achieve the goals of Vision 2020, which aims to improve the hygiene condition of the population and environmental health by stimulating harmless waste disposal methods from community and health facilities, Auditor and Finance (2016). Because of this and rapid urbanization, specialization in conducting an EIA in waste management will result in the achievement of good environmental health conditions. In addition, fifty-seven percent showed that are specialized in water that can contribute in achieving the environmental protection goal.

However, fifty percent of respondents are specialized in mining, this was expected since the mining industry in Rwanda is a key focus area that plays a significant role in the economy of the country(Cole & Hogarth, 2011). Even though mining contributes to economic development but its activities can destruct the environment, starting from the exploration phase, exploitation and closing phase. Those impacts including land degradation, soil erosion, deforestation, landscape change, destruction of habitat, the formation of sinkholes, loss of biodiversity, contamination of soil and groundwater by the chemicals from mines, etc.(Geelani et al., 2016).

Thus, mining requires an EIA to mitigate and minimize the diverse impact of those mining projects that can have on the environment. so to have a big number of EIA practitioners specialized in this sector has significant importance in achieving environmental protection and environmental mining-friendly as well. Moreover, their input in the EIA reports helps in decision making. Other environmental components involved are air quality, landscape, mining, transport, energy, soils, social economics, noise pollution, agriculture, and others.

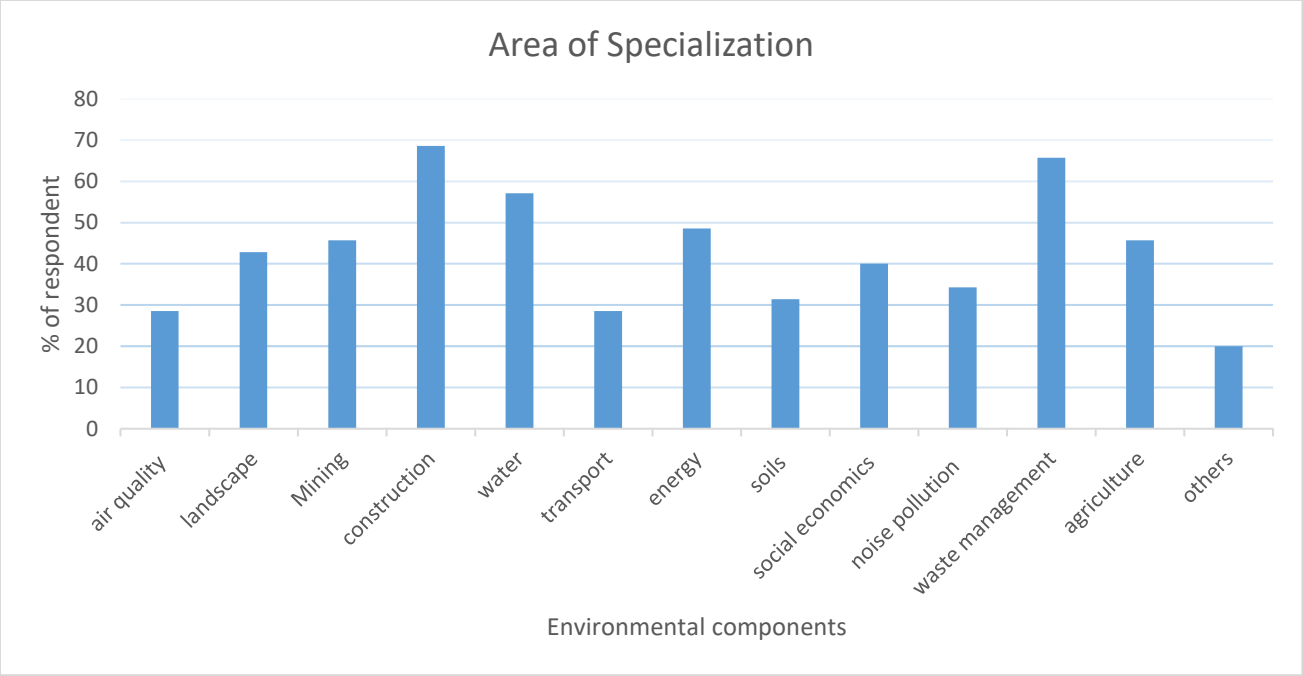

Figure 9: Specialization Area of the Respondents

4.1.6. Alternatives in the EIA process.

The respondents were asked if there have been a possible alternatives suggested in the EIA process, Around fifty six percent of surveyed respondents stated that the possible alternatives have been suggested in their current practice of the EIA. The given examples of their input in proposing the alternatives showed that it had a positive impact on the project as well as on environmental protection. This can result in the improvement of EIA effectiveness at decision-making.

However, EIA seeks to compare the many available alternatives, of the project or program which requires an Environmental Impact Assessment. (Morgan, 2017). However, each alternative may have an economic cost or benefits, and environmental impacts also have adverse and benefits, so EIA aiming at comparing the possible alternatives that represents an optimal mix of benefits, economic cost and environment. DoE (2008) although, the Requirements to assess alternatives are overall proactive.

Therefore, the alternatives play a role in finding the best way to achieve the need and the purpose of the proposal, both in improving the environmental benefits and by reducing the significant negative impacts of the proposed activities. (www.deat.gov.za).

According to Kamijo and Huang (2016), public participation and alternatives analysis can affect the improvement of EIA report's quality but only one of them cannot have any effects on the quality of EIA reports.

However, up to forty four percent of the surveyed respondents said that they had never proposed the alternatives in their current EIA practice. But alternatives consideration is relevant in a context of EIA and Strategic Environmental Assessment (SEA) (Holman, 2011).

4.1.7. The main purpose of EIA

Up to sixty-three percent stated that the main purpose of conducting an EIA in Rwanda is to protect the environment; this can have an impact on the economic development growth of the country and environmental protection, if people are aware and implement the EIA purpose. Although, Rwanda is fast tracking on the development through construction, agriculture, tourism, etc., it is very crucial to ensure the protection of the environment so EIA should be more important in such circumstances.

Up to twenty five percent of the respondents mentioned that EIA has the importance to minimize the impact of the project that might have on the social-economic and environment and to contribute to sustainable development. However, the reason to conduct an EIA in Rwanda is to provide the information to decision-makers by identifying the potential environmental effects and risks of the proposed projects and promote sustainable development (REMA, 2006).

Twenty-two percent of respondents stated that EIA helps to identify social & environmental impact and environmental & social safeguards. While nineteen percent of respondents said that EIA has the importance of providing mitigation measures on projects or activities that might generate impacts (high, low or medium) during the implementation.

The other purpose of an EIA mentioned is to contribute to informing decision-makers, developers and the public about the EIA process as well as the project development.

See (Table 4). To communicate with the project owner about the risk of the project it is very important because the mitigation measure is taken and showing them how to implement so this can also diminish the financial risk. However, the private sectors use EIA to diminish financial risk and to increase the financial opportunities where is possible (Morgan, 2012). EIA is a decision making aid for the formulation of action development and a sustainable development tool; Glasson, et al 1(999). It was also seen also that EIA is a source of information necessary to make a good choice of a solution when making the decisions about the project proposal, Morgan (2012).

Moreover, EIA has an important purpose in decision making that helps to prevent projects with a strong negative environmental impact and to inform decision-makers by assigning negative environmental and social impact (Campion & Essel, 2013).

Referring to the respondents' view, this shows that different people involved in EIA whether the EIA practitioners, EIA developers or other related institutions know a theory of EIA in Rwanda, which should contribute to the good practice of EIA and sustainable environmental protection.

TABLE 4: THE MAIN PURPOSE OF EIA IN RWANDA

Responses	Respondents	Respondents (%)
Environmental protection	20	63
Identify social & environmental impact	7	22
Provide mitigation measures	6	19
Minimize the negative impact of a project	8	25
To inform decision-makers	7	22
Contribute to sustainable development	8	25
Environmental & social safeguards	7	22
reduce accident	2	6
To inform developers & public about EIA process	4	13
Sustainable implementation of the project	1	3
Project implementation with the help of environmental laws & regulation	2	6
Others	9	28

4.1.8. People's perception on EIA in Rwanda

The majority of surveyed respondent showed that they are aware of the EIA system, practice and requirements. Those are the EIA practitioners, competent institutions and some of EIA developers (project owners), as shown in table 5 below 86% said that EIA is a necessary tool to protect the environment, to inform decision-makers and developers about the adverse impact of the proposed development project to the environment.

However, (table 5) also shows that 71% of EIA experts said that EIA process is costly and; at times they consider EIA because it is mandatory and to get environmental authorization and approval for project implementation. As a result, this may cause the big problem to implement what is documented in the EMP as proposed by EIA experts. For example, to implement the mitigation measures or alternatives.

Therefore, they found that EIA is expensive and it is time-consuming. (Munyazikwiye, 2011) also mentioned that the EIA developers in Rwanda perceive that EIA is a cost barrier. Yet, Several project owners take EIA as an additional cost and time-consuming constraint on development but it was seen that they can benefit from EIA in the long run since it can provide a framework for considering location and design issues and environmental issues in parallel (Glasson et al, 2005; Morgan, 2012).

Moreover, development agencies and numerous projects developers are much concerned on the time and cost of EA therefore, they look a minimal process whereas the affected of influenced individuals and environmental interest groups are concerned about the substantive role of EIA in changing proposals and affecting decision making, Sadler (1999).

Yet, up to 57% of the respondents said that the mitigation measures cost is very high and it is a burden for them. also, project developers decide to find the second option, for example when they are asked to use the good quality of materials that are appropriate to protect the environment and find that is very expansive, the buy the fake ones or just ignore it because what they look first is their benefit. Therefore, the effect of the project on the environment and social-economic is not much cared for. This is a problem and can affect the effectiveness of EIA to mitigate the environmental impact.

However, one of the competent institutions said that this is due to a lack of collaboration between EIA experts and their clients as they should have the responsibility to explain well the importance of conducting EIA and providing the mitigation measures without writing the report and developer do not know the value of EMP.

Though the respondent stated that this is due to lack of enforcement on the follow-up, audit, and evaluation to make sure that the proposed mitigation measures are well implemented, this can have an impact on the EIA effectiveness in Rwanda.

TABLE 5: PEOPLE'S PERCEPTION OF EIA IN RWANDA

No	Responses	Respondents (%)
1	EIA is conducted to get a certificate	43
2	EIA process takes a long time	29
3	EIA delaying the implementation of the project	29
4	EIA experts are very expensive	71
5	EIA mitigation measure cost is high	57
6	To protect the environment	86
7	EIA contributing to decision making	86
8	EIA is conducted to get a bank loan	57

4.1.9. Strengths of current EIA practice in Rwanda.

Table 6. Shows that up to 36% of respondents mentioned that the legal framework is clear & strong, while 24% stated that there are governmental will and support, which strengthen the EIA practice in Rwanda. This is shown by a literature review where there are low, policy, order and regulations that support EIA and the institution in charge to coordinate and to monitor the implementation. According to (Munyazikwiye, 2017), the government as a regulator has the following responsibilities: putting in place, updating the regulations, laws, and ensure the implementation of mitigation measures, to speed up the EIA process, and enforcing and audit the projects.

Up to 20% of surveyed respondents said that the guidelines are clear and comprehensive. 16% see that RDB, REMA and RAPEP, and other concerned institutions working together to handle the environmental issues but still there is a need for improvement for effectively achieving EIA practice in Rwanda and said that there is a lack of enforcement.

Eight percent of respondents said that the Time of processing EIA has been reduced due to an online system. An online system has reduced the time and cost spent for the EIA application, the other strength of current EIA practice including issuing an EIA certificate before the project start, An EIA is enforced by law, strong institutional framework, etc.

TABLE 6: EIA PRACTICE STRENGTH IN RWANDA

Responses	No of respondent	% of respondent
supervision by REMA	3	12
RDB, REMA&RAPEP working together	4	16
following worldwide environmental guidelines	1	4
TOR&EIA reports being analyzed by RDB	2	8
the institutional framework is strong	2	8
online system	2	8
governmental support	6	24
a legal framework is clear & strong	9	36
expertise available	2	8
guidelines are clear and comprehensive	5	20
agency in charge of overseeing EIA	3	12
quick service due to online service	2	8
the system is good at providing clearance before any activity	1	4
it is taken as the main pillar of sustainable development	1	4
Good institutions and qualified personnel	1	4
An EIA is enforced by law	1	4
The reduction of EIA processing time	2	8

4.1.10. Weaknesses of current EIA practice in Rwanda.

Table 7 below, summarizes the weakness of current EIA practice in Rwanda as pointed out by the respondents, as indicated by respondent were insufficient monitoring of Environmental Management Plan; 45% of the respondents said that there is a lack of follow up in terms of monitoring, evaluation and audit during project implementation and operation by Government Authorities have to check implementation of the proposed Environmental Management Plan or terms of conditions from RDB. However, Follow-up, management systems, and monitoring are tools to achieve the effectiveness of EIA. (Sánchez & Gallardo, 2005). The study conducted in São Paulo State, Brazil showed that a follow-up system was the most driver for the effective execution of mitigation measures (Sánchez & Gallardo, 2005).

However, the respondents 'point of view is that the EIA Experts who conducted an EIA study can be allowed to be involved in the monitoring/evaluation process during implementation of the project to make sure the Environmental Management Plan is well implemented as proposed by EIA experts. EIA practitioners think that if there is no follow up to the mitigation measures or alternatives proposed to mitigate the impacts of the projects will never be implemented. Without follow-up, the results of EIA activities will not be known, the activities such as monitoring and auditing are needed.

Thirty percent of the respondents mentioned that the big weakness of current EIA practice in Rwanda is inexperienced practitioners (no capacity). Those respondents said that on the basis that EIA is still new in Rwanda, they have been encouraging many individuals as possible to participate in carrying out EIAs that increased the number of inexperienced people and created a problem of increasing number inexperienced practitioners who are quit of work is of poor quality.

They surveyed respondent also stated that there is a lack of professionalism and ownership 25% from consultants conducting EIA studies that result in Copy paste of many EIA reports because of the lack of ownership, thus poor quality of reports and most of the time underestimation of the actual impact of projects or activities. One of the interviewers stated that the EIA study does not conduct properly to acquire social economic and environmental information that results in the poor quality of the EIA report. However, there are many reasons for the poor quality of EIA reports but one of the main causes is that too many EIA reports are prepared within inefficient environmental information and data.(Zvijáková et al., 2014).

TABLE 7: WEAKNESS OF CURRENT EIA PRACTICE IN RWANDA

Responses	No of respondent	percentage
insufficient follow-up	6	30
insufficient monitoring of EMP	9	45
low enforcement by REMA	4	20
lack of professionalism of EIA practitioners	5	25
lack of public participation in EIA process	5	25
Lack of capacity building (Training).	4	20
lack of expertise in some field	1	5
lack of implementing mitigation measures	4	20
Inexperienced practitioners (no capacity)	6	30
Lack of ownership from consultants conducting EIA studies	3	15
copy paste of many EIA report (lack of quality report)	5	25
At RDB small team review the EIA reports	4	20
institutional coordination is weak	3	15
EIA implementation and Auditing are weak	6	30
some projects work without EIA certificate	1	5
A long process of obtaining the EIA certificate	1	5
Lack of EIA information at developers' side	4	20
EMP is not implemented by developers	5	25
others	6	30

The other thirty percent of respondents (EIA practitioners and other competent institutions) stated that there is insufficient EIA implementation and Auditing. This is a problem for the effectiveness of EIA practice in Rwanda since the objectives of EIA cannot be achieved. According to (Sánchez & Gallardo, 2005)The effectiveness of environmental impact assessment depends largely on fully implementing cost-effective mitigation and other management measures to prevent significant environmental degradation.

Up to 25% of surveyed respondent said that there is a lack of EIA report quality, where found that in many EIA reports consist of copy and paste for the fact that some EIA experts do not have

enough time for EIA study and others do not have enough capacity and experience to produce the quality report. However, the quality of Environmental Impact Assessment Reports is one of the three major measurements of a successful EIA framework includes an adequate institutional arrangement for EIA, the quality of EIARs, and implementation of mitigation measures, (Kamijo & Huang, 2016).

As effectiveness is a sign of the degree to which "the EIA process has measured up to its procedural requirements and substantive purpose"(Sadler, 2004), there is an assumption that poor quality reports could contribute to an ineffectiveness since they have the significant information related to the project which utilized in decision making. (Glasson, 2005).

However, the other 25% of respondents said that there is a problem with a small team to review the EIA reports submitted by the consultants all over the country. Moreover, they thought that it should be the cause of poor quality of EIA report as the consultants do without much caring about the quality because they know that their report will never be reviewed enough. Also, others said that the level of analysis of the EIA reports by RDB is not satisfactory and their point of view is that the reports had to be analyzed by a professional structure in the EIA field. It was seen that only five staff from RDB are responsible to review all EIA reports in the country.

however, some of the respondents from governmental institutions thought that the issue is not about the small number of EIA reviewers but the professionalism and capacity of EIA practitioners to produce a quality report, not copy and paste others reports which can be easier to review.

However, 20% of respondents mentioned that there is no training for EIA practitioners for capacity building; this is can affect the EIA effectiveness in Rwanda. However, capacity building should be among the top priority in different sectors to secure good practice for today and the future. According to ECA (2005), EIA training needs to relate not just to government officials but also to personnel in environmental consultancies, research institutes, and universities. Therefore short-term and long-term specialization course is necessary and important.

Other weaknesses mentioned were the Lack of ownership from consultants conducting EIA studies 15 %, this may affect the EIA practice effectiveness since the ownership is a key when conduction an EIA as you should have the ambition to meet the EIA objectives effectively. Lack of capacity building, Lack of EIA information at developers' side and others see. Six percent of respondents mentioned that there is a lack of experts in specific sectors, which is a weakness in

EIA practice in Rwanda. This has been supported by (ECA, 2005) which indicates that many African countries face the challenges of inadequate expertise of EIA practitioners in different sectors which affect the effectiveness of EIA.

4.1.11. How to improve EIA effectiveness in Rwanda

This section presents some of the ideas offered by EIA practitioners as suggestion to improve the quality and effectiveness of EIA in Rwanda. One of key elements that stands out is incorporation of the results/ findings into decision-making process, and removal of subjectivity. These would assist in removing bias and would highly boost the effectiveness of the EIA.

TABLE 8: MEASURES TO IMPROVE EIA EFFECTIVENESS IN RWANDA

Responses	No of respondents in %	No of respondent
Coordinate EIA and territorial planning	19	6
Simplify the EIA process	16	5
Improve the quality of EIA documentation	56	18
Remove the possibility of subjective decision making	22	7
Incorporate results into decision-making mechanisms	88	28
Permit documentation by qualified persons	41	13
Make the process electronic and digital	28	9
EIA follow up made by a single institution	53	17

The surveyed respondents were asked what should be done to improve the effectiveness of EIA in Rwanda. A big number of the respondent, eighty height percent stated that to improve the effectiveness of EIA they should introduce multiple controls, even after the EIA process, and incorporate the results into decision-making mechanisms. (See Table 8), 56% of respondents showed that the quality of EIA documentation has to be improved, fifty three percent of respondents thought that EIA process, enforcement and follow up should be made by a single competent institution. Forty one percent of surveyed respondents suggested that only qualified persons should make permit preparation of documentation. Others said that to improve EIA effectiveness in Rwanda, the EIA process has to be electronic and digital, coordinate EIA and

territorial planning and simplify the EIA process. Thus, Effective EIA should reduce the environmental impact of development. (Harmer, 2005).

4.1.12. EIA process legislation enforcement in Rwanda.

EIA enforcement really works if the Environmental Laws are correctly applied. As effectiveness is a sign of the extent, to which the process has complied with the legal requirements (as demanded by the environmental law and principles of Sustainable Development). And its intended objective.

TABLE 9: EIA LEGISLATION ENFORCEMENT

Responses	No of respondent	% of respondent
Strongly disagree	0	0
disagree	2	6
neutral	1	3
agree	24	75
Strongly agree	5	16

Table 9 above shows that (75%) of respondents stated that the EIA process is sufficiently reinforced in the legislation while only 6% think that the EIA process is not reinforced. This was expected since Organic law No. 04/2005 of 08/04/2005 determining the modalities of protection, conservation, and protection of the environment in Rwanda in its article sixty-seven said that each project might be subjected to EIA before getting the authorization for its implementation(Government of Rwanda, 2005).

Additionally, Ministerial Order no 001/2018 of 25/04/2018 determining the list of works, activities, and projects subject to an environmental impact assessment.("Official Gazette n°15 of 15/04/2019," 2019). National Environment and climate change policy said that the use of EIA has to be strengthened in productive investments and enforce their Implementation. (MoE, 2019). Those law, policy, and order show how EIA is considered and enforced in legislation.

4.1.13. The responsibilities of institutions participation in EIA process.

In terms of the environmental laws of the Republic of Rwanda everyone has the right and responsibility to protect the environment. The National Government are accountable for the environment; reviewing, approving and issuing EIAs. The National Government is therefore responsible to come up with standardised follow-up requirements, so that it can be cascaded to down to Provincial and District level for implementation. This must be in line with the Sustainable Development practices as recommended by the international environmental laws.

TABLE 10: INSTITUTION PARTICIPATION IN THE EIA PROCESS

Responses	Percentages	Number of respondent
Strongly disagree	0	0
disagree	22	8
neutral	22	8
agree	36	13
Strongly agree	19	7

Table 10 shows that the surveyed respondents accepted the statement about the sufficiency of the responsibilities of participating institutions. Thirty-six percent agree, nineteen percent strongly agree and the other twenty-two percent are neutral and disagree respectively.

4.1.14. Public participation in EIA

The main strength of an EIA process is lies in public participation, policy and legal framework, and the weaknesses are insufficient public participation and lack of professionalism for EIA practitioners. In Rwanda public participation, insufficient resources for EIA implementation and insufficient number of EIA decision-makers were identified as major challenges to EIA practice effectiveness.

TABLE 11: PUBLIC PARTICIPATION IN THE EIA PROCESS OF RWANDA

Responses	Percentage (%)	N of respondent
Strongly disagree	3	1
disagree	54	19
neutral	23	8
agree	17	6
Strongly agree	3	1

Table 11 above indicated that 54% of the public is not involved in the EIA process in Rwanda. Only twenty three percent agreed with the statement, three percent were strongly agree and the other seventeen percent were neutral, it shows that the public consultation and participation are inadequate like in other developing countries as shown in the literature review. This might have the negative impact of EIA effectiveness since Glasson, et al (1999) stated that public consultation and participation seek to guarantee the quality, comprehensiveness, and effectiveness of EIA so, when making the decisions, the public's views are taken into consideration. Also, the public participation has the following benefits: improve the quality of decision-making, minimizing cost and delay, consensus building, increased ease of project execution, avoiding worst-case confrontations, sustaining credibility and legitimacy, anticipating public consensus and attitudes, and developing civil society, Kamijo and Huang (2016).

However, It was expected since, EIA was seen as a challenge in Rwanda Marara et al., (2011). Ortolano and Shepard (1995) argues that public involvement occurs too late to take advantage of information that citizens can contribute to values, impacts and alternatives projects.

Lack of public participation in different EIA process should cause the impact on EIA effectiveness, refer to the literature review shown that there is inadequate public participate in scoping and in mitigation stages in Rwanda Munyazikwiye, (2017). However, the scope should begin with identifying all stakeholders including, individuals, communities, civil societies, local authorities and consultants who are likely to be affected by the development project and discuss together with the developer the issues to be considered during the EIA study. (REMA, 2006; Glasson et al., 2005) Yet, the public can play a big role in providing the baseline environmental data. Wood, (2003).

However, the public are key stakeholders in the development of the country and project implementation; they have the right to know and to be involved in the information exchanging and decision making that affects their lives, sources, and properties. and when the public is well informed and motivated, the project development should be well implanted (Zvijáková et al., 2014). Referring to research conducted in UK shows that fewer provision and consultation of stakeholders which should result in reduced effectiveness of UK EIA and the influence of the public on the quality of EIA was viewed as limited in UK and Netherlands (Arts et al., 2012). However, Marara et al., (2011) identified that one of the challenges of the EIA process in Rwanda is the lack of local capacity to work with EIA. Thus, the problem with public participation is not new, (Hartley and wood 2005), identified the following main barriers:

1. Lack of public capacity or knowledge to participate in the EIA process.
2. Poor or inadequate public's information provision
3. Lack of public's access to legal advice
4. Distrust of the waste disposal industries
5. Inadequate influence on the decision-making process
6. Poor implementation of participation systems
7. Regulatory constraints.

4.1.15. EIA practice effectiveness.

The EIA consultants and other competent institutions were asked whether they felt that current practice is effective at helping decision-makers, helping developers, reducing environmental impacts and contributing to sustainable development; table 12 provide a summary of their responses.

TABLE 12: RESPONDENT PERCEPTION OF EIA PRACTICE EFFECTIVENESS

Responses	Percentage (%)	Number of respondents
Helping decision-makers	71	27
Helping developers	87	33
Reducing environmental impacts	92	35
Contributing to sustainable development	71	27

The majority of surveyed respondents 94% said that normally the EIA practice is effective at reducing the environmental impacts but to be effective in Rwanda is still a challenge.
86% helping developers, and 71% at helping decision-makers and contributing to sustainable development. However, the respondents said that there is a need for improvement.

4.1.16. **Methodological guidelines.**

The surveyed respondents were asked if the methodological guidelines provided for the EIA process are sufficient. Up to sixty-one percent of respondents stated that the given methodological guidelines are sufficient, (61% agree and 25% strongly agree). Only six percent disagree with the statement. They said that methodological guideline is clear and understandable. When the methodological guideline is sufficient it can guide well the EIA practitioners, as it is the information intended to advise people on how something should be done.
Table 13 below summarizes the responses given in relation to the EIA guidelines provided in Rwanda. From the results it clear that EIA guidelines are not an issues or barrier for effective implementation of EIA.

TABLE 13: METHODOLOGICAL GUIDELINES

Responses	Number of respondents	Percentage
Strongly disagree	0	0
disagree	2	6
neutral	3	8
agree	22	61
Strongly agree	9	25

4.1.17. Assessment of EIA systems in Rwanda

Assessment of EIA system requires access to information, more often than not this information is not available owing to a variety of reasons. Hence, little empirical data has been collected as a result of low levels of EIA follow-up, enforcement and compliance monitoring. This can be attributed to a lack of experience and knowledge. User friendly measure to assess EIA's have to be developed; table below shows some of the responses provide in EIA assessment.

TABLE 14: EIA SYSTEM IN RWANDA

Statements	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Participation of public in decision making process	13.51	21.62	35.14	24.32	5.41
Monitoring implementation, Audit and post decision in EIA process	5.41	43.24	32.43	21.62	2.70
Providing of adequate powers of enforcement to EIA agencies.	5.41	13.51	24.32	29.73	10.81
Evaluation of alternatives to the project in the EIA process	13.51	13.51	13.51	43.24	16.22
The use of qualified multidisciplinary staff	13.51	10.81	18.92	43.24	18.92
Use of experienced EIA consultants	5.41	5.41	27.03	43.24	24.32
The provision of technical guidance on the content of the Environmental statement	0.00	13.51	24.32	51.35	13.51
Possession of analytical required for fieldwork, laboratory testing, and research	5.41	10.81	29.73	51.35	8.11
Difficulty to obtain EIA permit	29.73	29.73	21.62	13.51	5.41
Difficult to get EIA procedural guidelines	40.54	21.62	18.92	16.22	0.00
Time for EIA report to be approved/ corrected or rejected	5.41	13.51	10.81	29.73	5.41

Table 14. Summarize the EIA system in Rwanda. First, the majority of respondents thirty-five percent were neutral about the statement of the public participation in the EIA decision-making process in Rwanda. Thirteen percent strongly disagree and twenty-one percent disagree that the public participates in the decision-making process. however this was expected since in the literature review was seen that the public consultation and participation in EIA process is a challenge in Rwanda and developing countries as well, (Marara, et al 2011), this can cause the effect on the effectiveness of EIA practice since the public provide the important information to

be considered in decision making. However, only 24% agree that the public participates in the decision-making process.

Second, up to 43% disagree that there are a Post decision and implementation monitoring and audit provision, 32% are neutral and only 21% agree about the statement. This a problem for the EIA system of Rwanda and might affect the success of EIA practice. However, insufficient monitoring and auditing for the project implantation were seen as a problem in many cases were found that when a license or certificate is issued, the enforcement and control of an EIA requirement are not implemented. Yet, inadequate monitoring and auditing can reduce the capacity to find the feedback on the effectiveness of proposed mitigation measures implementation, also, long-term activities require monitoring and auditing to ensure the implementation of EIA(Kosamu, 2011).

Third, Examination of alternatives to the project in the EIA process in Rwanda was seen that is performed where 43% agree about the statement and 13% strongly agree while only 16% disagree. The EIA experts showed this also where they stated that they have been proposed the feasible alternatives in their EIA practice and that had an impact on the project development. However, Alternative analysis focuses on solutions, often-long term, rather than problems and can thus promote innovative thinking that can result in a good EIA practice. (DoE, 2008).

Forth, the majority of respondents forty-three percent agreed that the EIA system in Rwanda use qualified multidisciplinary staff, heighten percent strongly agree about the statement and only ten percent disagree. For the fact that the EIA experts in Rwanda have a different background related to environmental management, protection, environmental engineering, etc, which can improve the EIA practice.

However, the use of experienced EIA consultants was seen as an opportunity in the EIA system of Rwanda, forty-three percent agree with the statement and twenty-four percent strongly agree while only five percent disagree. This is a good opportunity when they use their experience in conducting an EIA.

4.1.18. Summary of the statistical questionnaire answers

The answers from the respondents were statistically analyzed to prove and justify the significant of the findings from this research. Regarding the result on the EIA practice and effectiveness, the figure 15 shows that the significance is on the question , 1,2,3,4,5,6,10,11,12,13,15,16,17,18,19 and 20. As the P value is < 0.05 which is significant.

TABLE 15: STATISTICAL SIGNIFICANCE OF THE QUESTIONNAIRE SURVEY ANSWERS

Question	P Value
1	0.003484
2	0.073142
3	0.001010
4	0.016305
5	0.004344
6	0.001078
7	0.239344
8	0.164602
9	0.709449
10	0.007121
11	0.000076
12	0.044615
13	0.019410
14	0.110029
15	0.036581
16	0.014307
17	0.010102
18	0.048847
19	0.016130
20	0.020118

4.1.19. General comments of the respondents.

The following are the selected comments from EIA competent authority and EIA practitioners about the improvement of EIA practice in Rwanda:

- Increase capacity building of EIA experts to efficiently conduct EIA studies (To provide special international training courses) negotiate the establishment of an EIA training center at the University of Rwanda or any Private institution to deliver standard EIA guidelines and procedures and practices.
- Allow the EIA Expert who conducted an EIA study to be involved in monitoring/evaluation process during implementation of the project to make sure EMP is well implemented as proposed by EIA expert
- Increase the number of EIA specialists in RDB to review EIA report and it's quality, follow up (monitor/evaluation/audit) of project implementation as proposed in EMP because after approval of the EIA and issuance of the EIA certificate, no follow up on the implementation of the safeguarded document. However, institutions in charge to ensure EMP Implementation supervision, monitoring and audit to be proactive have to be empowered.
- Reduce the bureaucratic process of EIA and reinforce practical aspects of the EIA process.
- A follow-up to make sure the consultants involved in the EIA study are working in a multidisciplinary team.
- Quality of EIA reporting needs to improve
- Involvement of the public in the EIA process especially at the stages where they are affected
- To set strong financial penalties on the firm or contractor who doesn't implement the recommendations provided in the EIA report.
- Provide awareness program to Local Government entities on the EIA process in Rwanda and on related Environmental regulations.
- Reinforcing awareness of developers to conduct and implement EIA
- reduce the time for EIA report approval & feedback
- To emphasizes that every project (either mining or transport or any other sector) should have its ToRs not thinking that all environmental aspects will be affected on the same level.
- The EIA process should be made by a single competent institution.

5. CHAPTER FIVE: CONCLUSION AND RECOMMENDATION

EIA practice in Rwanda was initiated to face several challenges of human activities to achieve sustainable development. However, EIA process and practice in Rwanda is still facing several challenges some of which are weak integration of EIA into decision-making system, poor quality of EIA reports and inadequate review, weak public consultation and participation in EIA process, weak implementation of mitigation measures and monitoring of impact, this explains the ineffectiveness of EIA practice in Rwanda.

Though, there is a government will to improve the EIA practice where there are strong legal frameworks, laws, policies, regulation and clear guidelines but still there is room for improvement.

Some Project developers took EIA as just a paper for clearing the project but it is not for serving the environment as planned.

Insufficient monitoring of mitigation measures proposed in the EIA merged is one of the major barriers preventing companies and organisation implementing EIA effectively to meet the requirements of Sustainable Development, so there is a need to enforce the follow-up and monitoring for the implementation of the project to make sure that the mitigation measures or alternatives proposed by EIA experts are considered.

Regular training for EIA practitioners based on EIA practice in Rwanda and international standards to achieve sustainable development objectives and prevent climate change is needed.

Increase of ownership and integrity among the EIA experts who provide the information that is helpful in decision-making and for the EIA developers who make the implementation.

Improve collaboration and interaction between the competent institution, EIA experts, EIA de Developers, and the local community to achieve the effective EIA practice in Rwanda.

Project owners, public institution and citizens need to understand the real importance of public participation and provide the framework for participating effectively.

The study recommends that a measure must be put in place to ensure monitoring of project impacts for the protection of the environment. This objective can be achieved by implementing the

approved EIA and EMP, and constant auditing. Means that the adverse environmental impacts identified by the EIA can be addressed;

The findings of the study revealed the consideration of cumulative impacts during the EIA process as one of the problem areas in the current EIA practice. This study suggests that the current monitoring be reviewed to improve the consideration of cumulative impacts. This requires the application of innovative tools and measures such as enforcing penalties.

6. Reference

Arkkelin, D. (2014). Using SPSS to Understand Research and Data Analysis. Psychology Curricular Materials 2014, 194. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.139.2050&rep=rep1&type=pdf

Arts, J., Runhaar, H. A. C., Fischer, T. B., Jha-Thakur, U., Van Laerhoven, F., Driessen, P. P. J., & Onyango, V. (2012). The effectiveness of EIA as an instrument for environmental governance: Reflecting on 25 years of EIA practice in the Netherlands and the UK. Journal of Environmental Assessment Policy and Management, 14(4). https://doi.org/10.1142/S1464333212500251

Baker, D. C., & McLelland, J. N. (2003). Evaluating the effectiveness of British Columbia's environmental assessment process for first nations' participation in mining development. Environmental Impact Assessment Review, 23(5), 581–603. https://doi.org/10.1016/S0195-9255(03)00093-3

Bina, O. (2008). Context and Systems : Thinking More Broadly About Effectiveness in Strategic Environmental Assessment in China, 717–733. https://doi.org/10.1007/s00267-008-9123-5

Campion, B. B., & Essel, G. (2013). Environmental impact assessment and sustainable development: A critical review. Environment and Natural Resources Research, 3(2), 37–51. https://doi.org/10.5539/enrr.v3n2p37

Cashmore, M., Gwilliam, R., Morgan, R., Cobb, D., & Bond, A. (2004). The interminable issue of effectiveness: Substantive purposes, outcomes and research challenges in the advancement of environmental impact assessment theory. Impact Assessment and Project Appraisal, 22(4), 295–310. https://doi.org/10.3152/147154604781765860

Cole, M., & Hogarth, R. (2011). Mining Sector Working Paper, (June), 60. Retrieved from

http://www.smithschool.ox.ac.uk/research/library/Rwanda_Mining-SWP-final_proofed.pdf

Department of Environment. (2008). Department of Environment Environment Impact Assessment (EIA) Guidelines. Retrieved from https://www.marineecologyfiji.com/fiji-eia-guidelines/

Du Preez, J. Haynes, M. & Paton, A. (1997). Practical implementation of Integrated Environmental Management in South Africa. The approach adopted by Umgeni Water, in proceedings IAIA-SA Conference, 1997.

EuropeanCommision. (2007). Environmental Integration. Environment. Retrieved from http://ec.europa.eu/environment/integration/integration.htm

Faustin Munyazikwiye, B., & Munyazikwiye Urmilla Bob, F. (2011). an Assessment of Environmental Impact Assessment (Eia) Procedures and Challenges Faced By Environmental Officers in Eia Implementation in Rwanda. Retrieved from http://researchspace.ukzn.ac.za/xmlui/bitstream/handle/10413/5363/munyazikwiye_faustin_2011.pdf?sequence=1

Fuggle, R. F. & Rabie M. A. (1999), Environmental management in South Africa (Juta, Cape Town).

Fuggle, R. F. & Rabie, M. A. (2009), Environmental management in South Africa (Juta, Cape Town).

Gebreyesus, sammy, Y. (2017). Review of EIA in East Africa: Challenges and Opportunities in Ethiopia and Kenya. Earth Sciences, 6(4), 44. https://doi.org/10.11648/j.earth.20170604.11

Geelani, M., Geelani, S. H., Haq, S. S., Mir, N. A., Qazi, G., & Wani, S. (2016). Mining and Its Impacts on Environment With Special Reference To Review Article Mining and Its Impacts on Environment With Special Reference To India. International Journal of Current Research, 5(12), 3586–3590. Retrieved from https://www.researchgate.net/publication/304675401_mining_and_its_impacts_on_environment_with_special_reference_to_india

GoR. (2007). Economic Development Poverty Reduction Strategy 2008-2012, 13(2), 171–177.

Government of Rwanda. (2005). Official Gazette of the Republic of Rwanda No . 04 / 2005 of 08

/ 04 / 2005 Organic Law Determining the Modalities of Protection , Conservation and Promotion of the Environment in Rwanda, (04).

Harmer, C. (2005). Is Improving the Effectiveness of Environmental Impact Assessment in the UK Dependent on the Use of Follow-up ? Views of Environmental Consultants by.

Holman, C., Management, A. Q., Quality, A., & Pm, B. (2011). EIA Quality Mark Article, 40–42.

Http://www.deat.gov.za. (2004). Alternatives in EIA.

John Glasson, Riki therivel, A. C. (1994). Introduction to environmental Impact Assessment. (2nd ed.).

John Glasson, Riki Therivel, A. chadwick. (1999). Introduction to Environmental Impact Assessment (2nd ed.).

John Glasson, R. T. and A. C. (2005). Introduction to Environmental Impact Assessment. Acta Montanistica Slovaca (3rd ed., Vol. 15).

Kabera, T. (2017). Environmental impact assessment in higher education institutions in East Africa: the case of Rwanda. Environmental Science and Pollution Research, 24(8), 7852–7864. https://doi.org/10.1007/s11356-017-8525-4

Kamijo, T., & Huang, G. (2016). Improving the quality of environmental impacts assessment reports: effectiveness of alternatives analysis and public involvement in JICA supported projects. Impact Assessment and Project Appraisal, 34(2), 143–151. https://doi.org/10.1080/14615517.2016.1176402

Kosamu, I. B. M. (2011). Environmental impact assessment application in infrastructural projects in Malawi. Sustainability Science, 6(1), 51–57. https://doi.org/10.1007/s11625-010-0122-0

Li, J. C. (2008). Environmental Impact Assessments in Developing Countries: An Opportunity for Greater Environmental Security?, (4), 2. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.562.7417&rep=rep1&type=pdf

Marara, M., Okello, N., Kuhanwa, Z., Douven, W., Beevers, L., & Leentvaar, J. (2011). The importance of context in delivering effective EIA: Case studies from East Africa. Environmental Impact Assessment Review, 31(3), 286–296. https://doi.org/10.1016/j.eiar.2010.10.002

MoE. (2019). National Environment and Climate Change Policy, (June), 1–59.

Morgan, R. K. (2017). Conceptualising best practice in impact assessment. Environmental Impact Assessment Review, 66(February), 78–85. https://doi.org/10.1016/j.eiar.2017.06.009

Morgan, R. K., Hart, A., Freeman, C., Coutts, B., Colwill, D., & Hughes, A. (2012). Practitioners, professional cultures, and perceptions of impact assessment. Environmental Impact Assessment Review, 32(1), 11–24. https://doi.org/10.1016/j.eiar.2011.02.002

Ngororero.(2013) District Development Plan (2013-2018).

Nhamo, P. G. G. (2016). Effectiveness of Environmental Impact Assessment follow-up as a tool for environmental management : lessons and insights from platinum mines along the Great Dyke of Zimbabwe. Environmental Earth Sciences. https://doi.org/10.1007/s12665-015-5219-4

NISRS. (2017). Statistical Yearbook: Introduction, 1–7. https://doi.org/10.18356/e41ef4c1-en-fr

Nugent, C. (2009). I0970E01B. Review of Environmental Impact Assessment and Monitoring in Aquaculture in Africa, 59–151.

Of, O., Auditor, T. H. E., & Finances, O. F. S. (2016). of State Finances , Rwanda Performance Audit Report on Management of Solid and Liquid (Sewage), (May).

Official Gazette n°15 of 15/04/2019. (2019), (15).

Ortolano, L., & Shepherd, A. (1995). Environmental impact assessment: Challenges and opportunities. Impact Assessment, 13(1), 3–30. https://doi.org/10.1080/07349165.1995.9726076

Rebelo, C., & Guerreiro, J. (2017). Comparative Evaluation of the EIA Systems in Kenya, Tanzania, Mozambique, South Africa, Angola, and the European Union. Journal of Environmental Protection, 08(05), 603–636. https://doi.org/10.4236/jep.2017.85040

Rema. (2006). GOVERNMENT OF RWANDA GENERAL GUIDELINES AND PROCEDURE, (November).

Sadler, B. (1996). International Study of the Effectiveness of Enviromental Assessment, 263. https://doi.org/EN106-37/1996E

Sánchez, L. E., & Gallardo, A. L. C. F. (2005). On the successful implementation of mitigation measures. Impact Assessment and Project Appraisal, 23(3), 182–190. https://doi.org/10.3152/147154605781765472

Taylor, P., Morgan, R. K., & Morgan, R. K. (2012). Impact Assessment and Project Appraisal Environmental impact assessment : the state of the art Environmental impact assessment : the state of the art, 5517(March 2015), 37–41. https://doi.org/10.1080/14615517.2012.661557

Therivel, P. M. and R. (2009). Methods of Environmental Impact Assessment (3rd ed., Vol. 111). https://doi.org/10.1192/bjp.111.479.1009-a

Wood, C. M. (2003). Environmental impact assessment: a comparative review. 2nd edition. England7 Pearson Education Limited.

Wood, G. (1999). Post-development auditing of EIA predictive techniques: a spatial analytical approach.

World Commission on Environment and Development WCED, 1997 - https://sustainabledevelopment.un.org/milestones/wced

RDB (2019) statistics of EIA certificates issued to the projects. (unpublished data)

Zvijáková, L., Zeleňáková, M., & Purcz, P. (2014). Evaluation of environmental impact assessment effectiveness in Slovakia. Impact Assessment and Project Appraisal, 32(2), 150–161. https://doi.org/10.1080/14615517.2014.893124

7. Appendices

7.1.Site visit at Ngororero mine.

Apart from results from literature review, field observation was carried out in Ngororero amethyst mine site in order to confirm the status of EIA status in some site in Rwanda.

The data gathered from the field, and observations made indicate that some actions in EMP were implemented. Such mitigation measures are rehabilitation of mine sites and protection of sediment were implemented in some sides at Ngororero Amethyst Mine Site, (see figure 11). However, there are still challenges of uncovered tailing and released water from mine site to the stream. (see figure 12).

The site visit was conducted in Ngorero District; Kavumu Sector of Tetero Cell. As many researches mentioned that mining is among the severe threats to environmental degradation. This site was selected as one of the large site (owned by repeatable company in Rwanda: Ngali mining) showing different landscape which should explain some environmental problem caused by mining and to assess how the owner of company(producer) is mitigating or implementing EMP on ground .

During the site visit field observation were made and captured in the form of photos and notes. Ngororero Amethyst Mine Site is characterized by the activities of the exploiting the minerals (Amethyst) through underground methods. The methods used in this site are pitting, trenching, drilling and excavation.

All of those methods are done by removing the trees and removing of the top soil, which causes environmental degradation. However, to mitigate those challenges the project has the EMP and EIA documents outlining the mitigation measures to protect environment and people's health surrounding the area. A walk around site, open pits were discovered as shown on the map bellow. The rock materials are likely to go down in the stream as shown that there is a near river called Rwibereko River which can cause water pollution.

This operation managed by a company and individuals who are aware of the EIA process and its requirements. They mainly do just enough to get their EIA and EMP approved. They usually lack genuine attempt to protect and rehabilitate the environment. Their processes are relative clean and they conform to some of the EIA requirements and the principles of Sustainable Development. Ngororero Amethyst Mine can be classified as medium-scale and employ semi-skilled labours. There is usually one or two environmental practitioners on site. It was found that in most cases they make use of consultants who guide through the EIA process.

Secondary to this, the operation is not fully compliant with the environmental regulations. Their non-conformance is mainly due to lack of resource (funding) and lack of EIA expertise. This led to periodic use of consultants, who are in turn not attached to the projects. Most the consultants are not experienced enough to identify environmental impacts and implement effective EIA measures.

Figure 10: Picture of open pit at ngororero mine site

Ngororero Amethyst Mine was referred to in this study as a case study for this type of operations. Heavy machinery as such excavators and bulldozers are used to for ground clearance and production. It is machines such as those that causes significant ground disturbance and severe environmental damage. Most of it owes to the use of diesel-powered engineers that pollute both the surface and ground water when leaks occur.

The Mine Site has fairly good health and safety principles and practices. The employees are trained to have basic understanding of both environmental issues and health issues. It was also found out that basic personal protective equipment is given as standard issue to all employees. Environmental, health and safety signage were visible around site to raise awareness, see photographs below.

Figure 11: Environmental Protection Measures to avoid downstream pollution

Figure 12: photograph depict an attempt to prevent soil erosion and preventing pollutants from the Mine contaminating water downstream. While the idea is good, the implementation is not great. Run-off can be seen leaking under the sand bag, this run-off transports fine particles from the mine and these particles pollutes water and vegetation. When minerals are exposed water and free oxygen they reach chemically and trigger acid mine drainage.

Figure 12: Released water and tailing deposit

Figure 13: A. Photograph showing a geotechnical and poorly designed mine on the hill-side. This type of excavation has potential to trigger a big landslide putting both the employees, machinery and the environment at risk. Geotechnical studies including slope stability must be employed to mitigate against landslides.

Figure 13: B. Photograph to the left shows fine material transported by run-off from the mine. Potential this run-off flows downstream from the hill-side polluting surface water bodies.

However, the project implemented one of the mitigation measures to avoid downstream pollution (sedimentation) proposed by the EIA experts. Mines and quarries in Ngororero Districts affect the environment by polluting the rivers and all the time water is dirty due to mining activities, as noted in Ngororero report (2013). However, on the other Side was shown the water released and loaded with too much sediments and dumping area of tailings towards left side of the mine; which are not covered to avoid the sliding.

7.1.1. Health and Safety Management at site.

Talking to the Site manager said that the project has the strategies to manage workplace safety hazards including Preparation of emergency response plans specifically applicable to exploitation and production activities (considering the often geographically isolated nature of mining sites…)

and including the provision and maintenance of necessary emergency response and rescue equipment. Continued saying that they have the communication program where their weekly talks emphasis on the health and safety.

However, to the extent that alternative technologies, work plans or procedures cannot eliminate or sufficiently reduce a hazard or exposure, Project owner (Developer) provides workers and visitors with the necessary Personal Protective Equipment (PPE), and provide instruction and monitoring in their appropriate maintenance and use. Applicable PPE include safety helmets and footwear, in addition to earmuff, eye, and hand protection devices as well as cask and the workers are trained how to use First Aid Kit.

Figure 13: Health and safety on the site

7.1.2. Mine Sites Rehabilitation Status.

Any mining site, after exploitation, must be left in good environmental state (in safety state). Within the framework of this project, based on environmental, economic and human criterion, Site manager said that in collaboration with local authorities envisage making an agricultural refitting and reforestation. Moreover, he said that they have already planted the trees where they have finished mining and afforestation around the mine site.

Figure 14: Afforestation of bamboo trees around mine site.

7.2. statistical significance of the questionnaire survey

Qwestion1.

Anova: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Column 1	5	26	5.2	12.2
Column 2	5	100	20	53.25987

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	547.6	1	547.6	16.73086	0.003484	5.317655
Within Groups	261.8395	8	32.72994			

Total	809.4395	9

Qwestion2.

Anova: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Column 1	13	91	7	15.16667
Column 2	13	557.1429	42.85714286	214.966

Question3

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	8357.276	1	8357.27551	72.63007	1.01E-08	4.259677
Within Groups	2761.592	24	115.0663265			
Total	11118.87	25				

Question 4

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Column 1	2	100	50	78.125

Column 2	2	3	1.5	0.5

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	2352.25	1	2352.25	59.83466	0.016305	18.51282
Within Groups	78.625	2	39.3125			
Total	2430.875	3				

Question5

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	1277.865	1	1277.865	10.10475	0.004343556	4.30095
Within Groups	2782.16	22	126.4618			
Total	4060.025	23				

Question 6

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	5107.782	1	5107.782	16.82657	0.001078	4.60011
Within Groups	4249.764	14	303.5545			

Total	9357.546	15				

Question 6

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	722.5	1	722.5	1.616147	0.239344	5.317655
Within Groups	3576.406	8	447.0508			
Total	4298.906	9				

Question 7

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	722.5	1	722.5	2.340198	0.164602	5.317655
Within Groups	2469.877	8	308.7346			
Total	3192.377	9				

Question8

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*

Between Groups	36.02941	2	18.01471	0.347095	0.709449	3.304817
Within Groups	1608.941	31	51.90133			
Total	1644.971	33				

Question 9

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	921.4412	2	460.7206	5.824491	0.007121	3.304817
Within Groups	2452.118	31	79.10057			
Total	3373.559	33				

Question 10

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	741.5123	1	741.5123	5.659654	0.044615	5.317655
Within Groups	1048.138	8	131.0173			
Total	1789.65	9				

Question 11

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	12094.22	1	12094.22	202.5914	7.52E-06	5.987378
Within Groups	358.1856	6	59.6976			
Total	12452.4	7				

Question 12

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	741.5123	1	741.5123	5.659654	0.044615	5.317655
Within Groups	1048.138	8	131.0173			
Total	1789.65	9				

Question 13

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	722.5	1	722.5	8.503088	0.01941	5.317655
Within Groups	679.7531	8	84.96914			
Total	1402.253	9				

Question 14

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	722.5	1	722.5	3.229787	0.110029	5.317655
Within Groups	1789.592	8	223.699			
Total	2512.092	9				

Question 15

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	722.5	1	722.5	6.281542	0.036581	5.317655
Within Groups	920.1563	8	115.0195			
Total	1642.656	9				

Question 16

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	1251.084	1	1251.084	25.80562	4.5E-06	4.012973
Within Groups	2714.941	56	48.48108			
Total	3966.025	57				

Question 17

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	722.5	1	722.5	11.21288384	0.0101018	5.31766
Within Groups	515.4785	8	64.4348064			
Total	1237.978	9				

Question 18

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	817.3137	1	817.313733	5.386817036	0.0488468	5.31766
Within Groups	1213.798	8	151.724799			
Total	2031.112	9				

Question 19

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	473.1209	1	473.120891	9.225052965	0.0161299	5.31766
Within Groups	410.2922	8	51.286523			
Total	883.4131	9				

Question 20

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	722.5	1	722.5	8.36724508	0.0201182	5.31766
Within Groups	690.7889	8	86.3486121			
Total	1413.289	9				

7.3.Questionnaire

SECTION A: Background of the Respondents.

1. Gender

   Male ( )

   Female ( )

2. Age

   18 -25 years ( ) 26 - 30 years ( ) 31 - 35 years ( ) 36 – 40 years ( ) 41 – 45 years ( ) 46 – 50 years ( )

   Over 50 years ( )

3. Education background

What is your highest degree? …….

Which have you graduated from:

University? …….

Faculty? …….

Department? ……

SECTION B: Experience in conducting EIA

1. How many years have you worked as a professionally qualified person?

Less than 1 year ( ) 1 – 3 years ( ) 4 – 6years ( ) 7-10 years ( ) others ( )

2. Approximately what proportion of your work time is spent on EIA?

   ……

3. How many EIAs have you been involved with in the last 3 years?

   0-2 ( ) 3 – 5 ( ) 5-7 ( ) others ( )

4. Which stages of the EIA process are you predominantly involved with?

   …….

5. When undertaking EIA which of the following environmental components do you specialize in.

   - air quality ( )
   - landscape ( )
   - Mining ( )
   - construction ( )
   - water ( )
   - transport ( )
   - energy ( )
   - soils ( )
   - social economics ( )
   - noise pollution ( )
   - waste management( )
   - agriculture ( )
   - others ( )

6. In which sectors (of industry) do you have experience of EIA preparation?

   ……

7. According to your current practice, have any feasible alternatives been proposed in the EIA process? …….

8. In your opinion, what is the main purpose or importance of EIA in Rwanda?

   ……

……

9. If you were given the opportunity to improve the effectiveness of EIA, what would be your top priorities? The main priorities for improving the effectiveness of the EIA process in Rwanda:
    - coordinate EIA and territorial planning ( )
    - simplify the EIA process; ( )
    - improve the quality of EIA documentation; ( )
    - remove the possibility of subjective decision making and evaluation; ( )
    - introduce multiple controls, even after the EIA process, and incorporate the results into decision making mechanisms; ( )
    - permit preparation of documentation only by qualified persons; ( )
    - Make the process electronic and digital. ( )
    - EIA process, enforcement and follow up made by a single competent institution. ( )
    - others( )

SECTION C: EIA legislation and guidelines

1. Do you think the EIA process is sufficiently reinforced in the legislation?

1=Strongly Disagree ( ) 2=Disagree ( ) 3=neutral ( ) 4=Agree ( ) 5=Strongly Agree ( )

2. Do you think that the methodological guidelines provided for the EIA process are sufficient?

1=Strongly Disagree ( ) 2=Disagree ( ) 3=neutral ( ) 4=Agree ( ) 5=strongly agree ( )

SECTION D: EIA Practice and perception

3. What are the strengths of current EIA practice in Rwanda?

……

……

4. What are the weaknesses of current EIA practice in Rwanda?

……

……

5. In your opinion, how do you perceive an EIA?

6. Do you feel current EIA practice is effective at helping:
    - Helping decision-makers ( )
    - Helping developers ( )
    - Reducing environmental impacts ( )
    - Contributing to sustainable development. ( )
    - all ( )
    - Others ……

7. Do you think objectivity is important in predicting the environmental impact in the EIA process?

   1=Strongly Disagree ( ) 2=Disagree ( ) 3=neutral ( ) 4=Agree ( ) 5=strongly agree ( )

8. Are the responsibilities of participating institutions sufficient?

   1=Strongly Disagree ( ) 2=Disagree ( ) 3=neutral ( ) 4=Agree ( ) 5=strongly agree ( )

9. Do you think the public is well informed on the steps of the EIA process?

   1=Strongly Disagree ( ) 2=Disagree ( ) 3=neutral ( ) 4=Agree ( ) 5=strongly agree ( )

10. Are the input data in processing documentation in EIA procedure easily accessible and of the required quality?

    1=Strongly Disagree ( ) 2=Disagree ( ) 3=neutral ( ) 4=Agree ( ) 5= strongly agree ( )

11. Assessment of Rwandese EIA systems according to indicators of best practice rank using Likert scale, 5 strongly agree, 4 Agree, 3 neutral, 2 disagree, 1 strongly disagree).

Statements	1	2	3	4	5
Public participation in EIA decision-making					
Post decision and implementation monitoring and audit provision					
Provision of adequate powers of enforcement to EIA agencies					
Examination of alternatives to the project in the EIA process and report					
The use of qualified multidisciplinary staff					
Use of experienced EIA consultants					
The provision of technical guidance on the content of the Environmental statement					
Possession of analytical required for fieldwork, laboratory testing and research					
Difficulty to obtain EIA permit					
Difficult to get EIA procedural guidelines					
Time for EIA report to be approved/ corrected or rejected					

12. If you were given the opportunity to improve EIA practice in Rwanda, what would be your top priorities (recommendation)?

    ……

    ……