



COLLEGE OF ARTS AND SOCIAL SCIENCES

CENTER FOR CONFLICT MANAGEMENT

EFFECT OF MINING SAFETY RISKS ON HUMAN SECURITY IN RWANDA

A CASE OF MINING INDUSTRY IN MUHANGA DISTRICT

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for the Award of Master Degree of Arts in Security Studies.

Presented by

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Nyakinama, 9 May 2020

DECLARATION

This is my original work and it has never been submitted to any institution of higher learning for the award of master's degree of arts in security studies

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Date: April 2020.

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ABSTRACT

Mineworkers experience different mining related risks that put their live on a threat though out their mining activities. Thus, becomes the main purpose of the researcher to conduct a study to examine the effect of mining related safety risks to human security in Muhanga District. This researcher was guided by theoretical framework of normal accident theory, high reliability theory and safety control cost theory. This study has also use descriptive research design with both qualitative and quantitative approach that applied purposive sampling techniques on 69 respondents.

The findings of the study have revealed that 52 (75.4%) of respondents agreed that they use safety materials provided by their companies during activities of mining, and 57 (82.6%) of total respondents have seen nobody experiencing fatality related to mining. The results have also shown that there is a relationship between mining fatalities and personal security ($p=.438$ and $\text{sig}=.000$), between mining fatalities and health security ($p=.470$ and $\text{sig}=.000$), and between mining diseases and economic security ($p=.468$ and $\text{sig}=.000$) because all calculated p-values are under 0.01 level of significance.

In conclusion, basing on the findings of the study it was recommended that there should be periodic review of mining safety, protecting environment and closing abandoned sites, provision of life insurance, use of technology in mining industry, provision of safety notices in all mine sites, adoption of latest standards of mining safety provision of PPE to all mineworkers, mining companies and government should give professional training to the mineworkers.

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CHAP ONE: GENERAL INTRODUCTION

1.1. Background of the Study

For centuries, minerals contributed to human security in both traditional and modern societies, minerals have helped humankind to make traditional weapons that have helped much in protecting people from animals and other dangerous in the forests of traditional society. Minerals remain essential in forming home and office materials including aluminum caps to electronic chips of cell phones and computers (Suekuni *et al.*, 2016). Mining industry has embarked large investments that bring economic growth and human security to countries that are blessed with minerals (Shields, 2015). However, mines have become sources of evil due to selfishness of man that led humankind to construct big weaponry machines and develop nuclear weapons which threaten the human security to be attained through better use of minerals (Qafoku, 2008). Extraction of minerals employs a big number of people compared to other sectors across the world but this sector accounts a very big number of fatal deaths, permanent disabilities that affect health of the miners and environmental risks including favoring disasters, floods, soil erosion and pollution.

In Africa, the mining industry has directly affected the economic growth of a number of countries as a primary source of foreign direct investment; it was also a source of tax revenues to government that enhances human security in seven dimensions such as personal, health, environmental and political security (Panel, 2013). Despite, the persistence of extreme poverty and hunger hitting Africa due to corruption and poor infrastructures, health and environmental risks that hinder the development of mining sectors and human security. Rwanda Mining Association asserts that mining sectors is steadily positioning itself as one of the key drivers of Rwanda's economic Transformation (Van Teeffelen, 2012). Mines are the main commodities that are exported and significantly affect the economy and growth of the country, opens new doors of employment opportunities, poverty reduction, economic stability and attainment of basic needs and fee for health scheme (MINIRENA, 2009).

Mineral have become a very important source for revenue, whereby the year 2006 - 2008, the mining and quarrying incurred an exceptional performance of 54 million of US dollars in 2007 and 63 million of US dollars in 2008but 10 years later in 2018 the minerals production was \$ 600 million. Despite, the exceptional performance and the importance of mining

activities on economic growth and development of a nation, the mining health safety risks remains causing fatal deaths, permanent injuries and diseases. It is in this context the research wants to conduct a study to find out the effect of mining safety risks on human security of Muhanga Mining Industry in Rwanda.

1.2. Research Problem

UNDP (2003) viewed security as a shift from traditional view of security as national security and military power to human security as an increase of people's potential to meet livelihood and long life expectancy, poverty free and freedom of choice, raising standards of living through attainment of decent employment, better health and education to foster human development and security particularly. Mining industry has become the key component to vitalize the attainment of such human security as described by UNDP (2003) in its definition of human security.

Most of the researchers in this field of mining and human security have given a lot of attention the contribution of mining industry on economic growth and development of the country. It is true, mining areas have incurred rapid and stable infrastructure development such as means of transport and communication, schools, health center, railways and roads to facilitate the movement and transportation of mines and to help miners in case of emergencies (Osanloo, 2014). However, fewer researchers, demonstrated that though there is rapid growth and development of countries blessed with minerals, mining related risks keep increasing and takes life of many mine workers and leave others with permanent injuries (Brody *et al.*, 2010).

Although the mining industry has made a significant contribution to economic growth and development of Rwanda, reports show that a total of 81 people lost their lives in 2017 during mining activities (Mining Inspection Report, 2017). Muhanga District had 16 people who lost live which ranked it among the districts with high rate of mining safety risks that lead to death, permanent injuries and diseases. However, there no empirical studies conducted to analyze the effect of mining safety risks on human security though reports keep showing that human security is threaten in mining sector compared to other sectors in Rwanda.

Another report of Mining Inspection (2019) have shown that in 2018, mining sector experienced another incident whereby 21 mine workers were seriously injured while 5 lost their lives while conducting mining activities. Despite, the effort of Government of Rwanda to protect and ensure security of the people including mineworkers. It was seen that safety risk in mining sector is still the potential threat that impends human life. Hence, it is upon this context the researcher wants to conduct as a research study to assess effect of mining safety risks on human security of mine workers in Muhanga Distict of Rwanda.

1.3. Study Objectives

1.3.1. General objective

To assess the effect of mining safety risks on human security of mine workers in Muhanga District, Rwanda.

1.3.2. Specific objectives

- (i) To determine the effect of mining safety risks on human security of mine workers in Muhanga District, Rwanda.
- (ii) To examine the relationship between mining safety risks and economic security of mine workers in in Muhanga District, Rwanda.
- (iii) To establish recommendations to ensure mining safety of mine workers to enhance human security in in Muhanga District, Rwanda.

1.4. Research Questions

1.4.1. Main research question

What is the effect of mining safety risks on human security of mine workers in Muhanga District, Rwanda?

1.4.2. Specific research questions

- (i) What is the effect of mining safety risks on health security of mine workers in Muhanga District, Rwanda?
- (ii) How is the relationship between mining safety risks and economic security of mine workers in Muhanga District, Rwanda?
- (iii) What are the recommendations to ensure mining safety of mine workers to enhance human security in Muhanga District, Rwanda?

1.5 Significance of the study

This study is useful in adopting new methods to use in mining industry of Rwanda to avoid injuries and fatal death, it is also benefiting to a number of the mine workers who knows the new methods that are applied by modern societies to avoid death, injuries and disease. It also significantly contributes to mine workers in providing awareness on the use of safety signage and improve communication to avoid risk and help to alert others in cases of emergencies.

This study is also so significant to policy formulators, researchers in the field of mining and human security, academicians in the field of human security and mining, teachers and student to use this material as point of references on the information that is related to the findings of this study. The policy formulators use the findings of this study to know where to put much effort while formulating the policy that govern the rights of mine workers and his safety at workplace.

The findings of this study is also added value in the other existing body of knowledge in the library of University of Rwanda at Center of conflict management in terms of mining related safety risks and human security. It is also significant to the researcher himself because it is among the requirement to help obtain a master degree in security studies and it broadens his understanding and perceptions about mining related safety risk and human security in Muhanga District, at national level and global level.

The uniqueness and significant of this study is based on the knowledge related to mining safety risks and provisions of safety related measures to control the risk of mineworkers at mine sites and give exemplary skills on how to keep the workers safety while

at workplace. It is always unclear to understanding how the safety of mineworkers should be reinforced to ensure both prosperity of the people and sustainability of the environment.

1.6 Limitations of study

The researcher expects to meet a number of challenges including time scope and geographic scope because this research was conducted during class sessions and this study dictated the researcher to go to collect researcher in very remote areas of Muhanga District at mine sites.

Another limitation was the insufficient grant of applicable literature of textual content books. Some respondents must be biased and suspicious of giving relevant answers on the questionnaire, which routinely can also have an impact on the great and quantity of records required to get information about mining safety and human security. Some of the respondents may additionally also be busy, due to the fact this mining activities use a lot of energy and may also need some additional time to respond to questionnaire.

However, the researcher used all the possible means to make sure that all the respondents respond to all the questionnaires, the researcher was visiting the mine sites every weekend when he goes to a weekend break, the researcher reached some mining sites by foot to make sure that he met all the mining workers in the remote areas in Muhanga District.

1.7 Scope of the Study

1.7.1. Content scope

This research was limited on assessing the effect of mining safety risks on human security of mine workers in Muhanga District.

1.7. 2 Time scope

This study was restrained to a period of solely five years, which used to be the period 2014-2019 because most of the case of mining related safety risks were highly recorded

during this period of time. Hence, it focused on the effect of mining safety risks on human security in Rwanda taking Muhanga District as a case study.

1.7.3 Geographic scope

This study was about to analyze how the impact of mining safety risks affect human security in Rwanda, Muhanga District as a case study. This study was conducted in Muhanga District located in Southern Province of Rwanda.

1.8 Research Organization

The information in this study is guided in five chapters. The first chapter gives an introduction that consists of study background, research problem, research objectives, study questions, significance of the study, scope of study, limitation of the study. The second chapter dealt once with the review of literature, which introduced the related literature. Chapter three used to be the research methodology that includes research design, sampling strategies, questionnaire, interview guide and ethical considerations. The fourth chapter described the research findings and interpretation. The fifth chapter contained details of conclusions, and recommendations of the researcher to various mining industry stakeholders in Rwanda.

CHAP II: LITERATURE REVIEW

2.1. Definition of key concepts

2.1.1. Mining

Mining refers to the process of extract minerals or geological materials from the soil / soil commonly from mineral body, veins, muds, seams and reefs or mineralized deposits (Zohar, 2002). While a mine site is defined as a mining concession or parameter recognized by Rwandan authorities through a mining license (RNRA, 2012). A mining site regularly has various sub-sites that occupy mining and are differentiated for traceability (Aryee, 2001).

The extraction of minerals from the mining site are carried out by agency or cooperative in a formally recognized mine site, generally via the use of advanced tools and equipment; in addition, it consists of semi-industrial mining operations or operations the place a mining enterprise subcontracts artisanal miners to extract minerals in Rwanda. Artisanal mining refers to cooperatives or human beings working in a mine site that use simple tools and equipment essentially for occasional manual processing and mining strategies such as ground filling and paving (RNRA, 2013).

Mining would have been properly the second activity conducted by humankind, given that agriculture was once the first. The two matters to do are mutually categorized and are considered the fundamental or predominant matters to do of preliminary civilization. However, with the onset of civilization, the significance of these industries has changed barely (Kula, 1994). Mining as a term was once generally used in the context of extracting solid, liquid and combustible mineral materials from the earth or other scrumptious varieties for really helpful functions (Madigan, 2011)

2.1.2. Safety risks

Safety risks refer to chemicals, electrical, radioactivity, biohazards, employee behavior, and other factors that may lead to unsafely working or living environment (Oakes, 2014). Many chemical substances are used in mining operations, especially in laboratories. The explosives used to break the rock are made of chemical materials that, if they are not well managed they may cause harm, as properly as damage to uncovered workers. According to

(Elliot 1981), these chemicals can enter into the body of mineworkers as respiratory dust, fuel fumes or steam via the mouth or nose. They can also enter the body through the shape of absorption thru the skin.

In underground mines, air flow is adequate, chemical compounds purpose various fitness problems, together with lack of oxygen, pores, and skin and eye problems. Mining is additionally related with terrible working conditions, with limbs exposed to organic dangers (Driscoll, et al 2005). Among the more than a few dangers affected are the dangers of snake bites and injuries. Bacteria, viruses, fungi and pathogens brought on by using blood are also at high hazard for mining employees. They are numerous safety risks associated to mining including mining diseases of respiratory system and lungs cause by air pollution and other chemical product, mining injuries that can even cause loss of part (s) of body or cause even permanent injuries, another risks that is even more worse is fatalities or death of miners or people around the mine sites all in relation to mining and death is always exposed to illegal miners (Drake et al, 2001).

2.1.3. Human security

Human security refers to shift from security grounded on national security to human security that includes the welfare of the people, development, antipoverty measures and strategies and all the means to ensure better living, life free of hunger and full of freedom of choice (UNDP, 2003). The concept of human security may also refer to an emerging paradigm to understand the global vulnerability in more advance way rather than traditional view of security as national issues rather as the human issue that primary affect people in environmental, community, personal, social, health, political interactions or concerns for the well- being of the human beings (UNDP, 2011).

A number of problem that expose humankind on vulnerability influenced the evolution of security associated to military power and boundaries and territorial defense to human security that involve security from issues like disasters, global warming, hunger, extreme poverty, terrorism and mining safety risks that put human life on threat. Therefore, these issues need extended force from primarily military to broadly incorporate social, economic, environmental, and political and health concerns (Taureck, 2006). In connection

with post-cold war definition developed by UNDP (1994), viewed security in a broad sense other than military and territorial concerns to human livelihood standards and dignity.

2.1.4. Mining fatality

Mining fatality refers to the mining related death of a mine worker which is caused by a mine accident that occurred not more than a year prior to the death occurrence and it has to be recorded in mine health and safety inspectorate safety statistics databases (Veiga and Beinhoff, 2017). However, mining casualties around the world are common as a result of lack of mining accidents, terrible mining techniques, lack of equipment and modern gear to use whilst mining and mining · Legal are the major cause of mining fatality (Turyaguma and Matsiko, 2001). Although the motives are various and different, higher methods of examining such incidents are sought in order to frequently end the recurrence of incident patterns (Mothemba and Mokoena, 2016).

The fatality agent is the principal reason of death in accidents. Although the main reason of death varies between mining operations, there is a clear definition of the dominant motives of dying (Alan, 2005). In instances where there were a couple of fatalities vendors, the former senior agent was once used. The gear worried is any tools or plant concerned in the accident or that was formerly exploding in the neighborhood that contributed to the accident. In the mining industry there is a wide variety of equipment, too tremendous to be absolutely accommodated and therefore compacted into huge classes (Corbett et al, 2000).

There are many sites within an on line mine site that can be fatal. A mixture of horrible protected work procedures, motion and operation of tools and placing earthworks can end result in many fatalities (Drake et al., 2001). Activities at the time of the mine accident are a fundamental type to think about when conducting the overview of mining fatalities. It is necessary to understand and apprehend what the victims have been doing at the time of the incident so that safety equipment, work techniques and administration can be multiplied (Cloette and Marimuthu, 2008).

2.1.5. Mining Injuries

Mining injury refers to mining resulted accident that cause a physical harm to the body of a mineworker at mine site (Charles and Oakes, 2011). A mining accident is an accident that takes place at some point of the mining system. Every year heaps of miners die from mining accidents, especially from underground coal mining, even though challenging rock mining is now not immune to accidents. Coal mining is regarded lots greater dangerous than difficult rock mining due to the flat rock strata, commonly incompetent rock, the presence of methane gas and coal dust. Most deaths these days' manifest in creating international locations and in rural components of developed countries.

Despite the large upgrades in mining protection in latest years, accidents have befallen and mining is, however, one of the most at-risk industries worldwide (Mendi, 2004). Accidents at work can have unfavorable influences on workers, corporations and communities. Workplace injuries have lengthy been considered one of the most disastrous outcomes prompted via administrative center accidents. The severity of work-related injuries is on the whole precipitated via the severity of the accident, the range of days misplaced and the amount of damage to physique parts. The severity of occupational injuries is a multifactorial phenomenon and a number of factors can contribute to it (Carnegie, Katsiaouni and Labonne, 2000).

2.1.6. Mining Diseases

Pollution brought on by quarries and explosions in mines will no longer solely amplify the dirt particles in the air and the surrounding environment, but also deploys toxic chemicals. Some of the toxic chemicals that end result from the explosion encompass cyanide and sulfur dioxide, which are very hazardous to the body. In addition, arsenic, which is used in the processing of crushed rock, flows into streams and rivers, the fundamental grant of drinking water for nearby residents, which impacts mining illnesses (Akabzaa and Darimani, 2001).

The mining method involves breaking the rock or removing the soil. These things to do generate a lot of filth and pebbles. This dust and pebbles can be a nuisance and can also be unsafe to the worker's body. According to Stellman and McCann (2018), free crystalline silica is the most essential compound in the earth's crust, and therefore the airiest dirt facing miners. On each occasion, repairable particles are shaped which are perforated, blown and

aggregated into an appropriate particle. Dust and pebbles can physically injury personnel or they can also motive physiological damage. Dust can additionally get to the eyes of concerned personnel if personal protecting gear (PPE) is no longer used properly. Dust and pebbles can additionally have an effect on imaginative and prescient and this can amplify the probabilities of accidents and can also have an effect on the skin which impacts all types of pores and pores and skin problems.

Noise additionally gives a fairly frequent place of danger. It is all the undesirable sound that motives soreness and interferes with efficiency, induces stress and disrupts focus (Stellman and McCann 1998). Donoghue (2004) highlighted that noise is ubiquitous in mining and is generated thru powerful machines, fans, flyers and transport in the area. Higher noise degrees stop accidents from occurring. Controlling noise levels has demonstrated challenging in mining, and noise-induced hearing loss (NIHL) is still a frequent bodily problem. The principal physical impact of prolonged advertising and marketing on excessive noise levels in the work location is the enhancement of occupational deafness or noise-induced hearing loss.

The tools and tools used in mining operations can reason a broad variety of terrible bodily effects for workers. Many machines used for mining tasks include transfer parts, sharp edges, and hot surfaces that can cut, stab and crush, hit, or coil workers if used safely. Mining machines can also mechanically purpose deaths and injuries to humans located in cases where a employee slips and falls on a pointed or pointed object (Heyns et al., 2000).

Vibration is separated into two effectively defined categories: entire physique vibration and hand-transmitted vibration (Griffin, 1990). Whole body vibration causes again problems, gastrointestinal and reproductive issues of the gadget. Manual arm vibration is a vibrating shape the place the hand is in contact with the vibrating equipment. According to Heyns et al (2000), prolonged publicity to vibration leads to hand-arm vibration syndrome, a persistent and modern sickness that impacts the vascular, neurological, and musculoskeletal systems. The first degrees of hand vibration syndrome are whitening, tingling and loss of contact sensitivity. This physical effect can development to high best hand loss and finger necrosis. Machinery such as hammers and heavy cars used in mining operations are targeted at good-sized diseases such as hand-arm vibration syndrome and, again, ache for most uncovered

workers. Vibration additionally influences the musculoskeletal system and effects in severe destruction of the tendons, muscles, joints and nerves (Campbell et al, 2002).

The mobile equipment used in mining activities contains large portions of diesel, lubricating oils, and extraordinarily flammable hydraulic fluids (Bickel 1987). The energized electrical equipment used in mining also carries an elevated chimney risk. Mitchell and Burns (1979) argue that materials or liquids that come in contact with warm exhaust gases or engine factors or a strength failure can quickly explode in a fast-spreading furnace that can motive excessive destruction to equipment and to uncovered workers, Hanson (2010) states that administration need to make sure that its safety and fitness management plans encompass a hearth security plan in instances where there are hearth dangers in any mining operation.

2.1.7. Health security

Mining operations can advantage workers, communities and the growth of national economy. They increase job related opportunities, abilities and income. Mineral extraction provides housing, physical care, and pensions to employees, and offerings and infrastructure in the areas where they function contribute to well-being and income security (Heath, Merefield, & Paithankar, 2013). They can boost the nearby economy, such as when they buy enter from close by corporations or improve their power buying in the local community. However, mining activities also transmit physical hazards and illnesses to people and surrounding communities (Camara et al, 2017).

Mining has been linked to excessive rate of accidents and injury to personnel due to the dangers induced by equipment and explosives that fantastically affect the physical situation of mine workers. Minerals ought to additionally be removed from the soil in open pit mines or underground workings. Working underground can be a very hard work environment and now and very unpredictable. There is a possibility of rock falls, tunnels and surfaces collapsing, injuring or trapping mining workers. Mining produces dust, noise and, in some mines, heat, chemical compounds and gases, which can additionally be mainly unstable for mine employees if they are poorly ventilated or exposed to pollution (Africa Progress Report, 2013).

There are several literatures texts on the mining risk safety and human security that provide fewer related information in the related field of mining safety risks and human

security. Hence, the need to identify the priority of having danger and controlling it at source. Only if furnish management is now not possible, the next steps are to minimize risk and use non-public defensive equipment. Mines have to observe these ideas to manage noise, vibration, fitness and ergonomic hazards, dust, chemical compounds and waste, and to ensure that mine trenches and faces are compatible safely (AMLA, 2017).

2.1.8 Economic Security

Economic security is a necessary factor of the national protection machine that is stipulated by the importance of the financial system in any social and financial device of production, consumption, distribution and redistribution of profits. Global modifications signify new challenges to the financial security system at more than a few levels, which require the corresponding reaction and implementation of unique movements at any of these levels. Challenges are characterized by means of having a long-term persona of cause-effect relationships. Consequently, it is feasible to determine the reality that the possible risks in the subject of protection are of an interdisciplinary nature, which requires a set of built-in actions at any level of managerial decision-making (Aryee, 2003).

In addition, researchers (Kovaleva, Rusetskiy, Shadrina, Kochyan, & Zarovnaya, 2018) thinking that present day manner development is accelerated in nature; thus, a forecast duration is shortened giving upward jostle to certain problems with long-term and medium-term forecasts, as nicely as desirable practices on fantastic measures in the discipline of security. Conceptual research such as De Soto, 1995; Keyns, 2007) cited financial safety classes that are based on scientific work such as research by means of mercantilists as they confirmed problems in protecting domestic markets in terms of the thinking of protectionism, classical political economics as balance of financial systems was once associated to the non-availability of the conflicts of hobby of the market entity, its coherence, rationality and historic school, as they are aware of the present day financial interest, each country can have the corresponding level and degree of economic culture, something which enables beneficial alternate with other civilized nations.

2.1.9. Economic Growth

Mining and mineral processing can become a potential source of income and the using forces in the back of broader economic development. But this conceivable does no longer always come true. In fact, mineral-dependent countries embody some of the world's poorest and worst-performing economies. Mining does not continually make a contribution to sustainable financial development (Awudi, 2002). As the national economic machine struggles to make the most of the Great Recession, the high charge of oil and the growing range of giants destined for the consumption of fuel herbs have created financial possibilities for rural communities.

Most of the country's economies can be considered as mineral economies that have established monetary boom and development. Therefore, if the issues of mineral dependence originate in a global change and their penalties in a nationwide economy, it would be exquisite to find out mineral exports with respect to complete exports, mineral exports as part of the whole export of items from one country. Going further, if mineral dependency troubles are the result of mining and how or not it is linked to home financial activities, then it would be notable to seem at the dimension of the mineral region with appreciate to the common economy as the rate contributed in mineral manufacturing as section of the gross domestic product (Acheampong, 2004).

2.1.10. National security

Kennan (2005) described national safety as the continual potential of pursuing their internal life, preventing serious interference. National security refers to and has referred to the requirement of governments and their civilian and marine leaders to keep and ensure the sovereignty and survival of the nation via the use of economic, army and political electrical energy and the exercising of diplomacy. Methodologies for obtaining and retaining the satisfactory possible country of protection across the united states have been developed continuously and subtly to establish, secure, and keep political, diplomatic, military, financial, and economic sovereignty and security (Baleni, 2001).

National safety is the protection of a state, consisting of its citizens, economy, and institutions, which is viewed a duty of government. Originally conceived as security against a naval attack, it is now widely understood that nationwide security encompasses non-military dimensions, which includes safety in opposition to terrorism, crime minimization, economic security, electrical security, environmental security, food security, cybersecurity, and security related to mining security (Brody et al, 1990). Governments remember on quite a number measures, along with political, economic, and navy power, as terrific as diplomacy, to protect the safety of a nation-state. They can additionally act moreover to build protection stipulations at the regional and global stages by means of reducing transnational reasons for insecurity, such as neighborhood climate change, financial inequality, political exclusion, and mining fatalities (Awaar, 2006).

National security is the engine of the economic growth and development of the country. Once, national security is also a broader term that constitute the economic security and partially other part of human security because it involves all the affairs of the country to ensure the rate of mining related risk is reduced through attainment of national security. National security also involves to rescue and save people in emergencies such as mining accident incident that can damage property and kill people.

2.2. Empirical Review

2.2.1. Mine accidents and accidents inside the mining industry

Mining is regarded to be a risky occupation based totally on the truth that mine people have to face exceptionally hazardous work environments due to warmth and gases that they are exposed to in contrast to employees in other industries (Kecojevic & Komljenovic, 2007). Most of the literatures have indicated that mines tools financial safety of the United States of America but it is additionally attached to loss of life among people and enhance bodily injuries, fatalities and diseases associated to mining (Groves & Radomsky, 2008).

The bodies of many of those who died underground have by no means been positioned or should be recovered, and their homes had been now not given the possibility to bury their loved ones resolutely and in accordance to rituals and African traditions. In the worst disasters, bodies recovered from mines had frequently been unidentifiable and families should

no longer recognize the bodies. This used to be unfortunate, certainly questioning of the risk of burying the incorrect our bodies if they insisted on acquiring the remains for ritual burials (Baleni 2011).

In 1996 at Rovic, twenty miners died and solely four our bodies have been recovered whilst at Vaal Reefs 104 guys died underground in 1995 and some of our bodies have been so mutilated that it was hard for ladies to identify their very own husbands. However; day-to-day mine people continue to risk their own lives and limbs by using going underground into ‘mazes of gold.

In the mines one can die at any time during the eight hours due to an earth fall, a gas explosion or excessive heat. However, due to the tough life of faraway villages where unemployment and hunger are the norm, working in the mines is a duty (Baleni 2011). Unfortunately, after accidents heaps of miners are dispatched domestic every year because of incapacity to perform responsibilities after sustaining accidents (Ndlovu 2008).

2.2.2. Causes of mine accidents and injuries

Biyase (2011) cited that the accident that claimed two lives at Harmony Gold Unisel, the Free State and the Limpopo North Platinum Mine in 2011 should be avoided. The Department of Mineral Resources (formerly Department of Minerals and Energy) insisted that mining agencies have to have an impact on a computerized model that prevents wagons from going for walks if there is a problem. However, these calls have been now now not cited in the manner of mining businesses due to the implementation expenses concerned (Kohler 2010).

Unfortunately, security is solely talked about in South Africa due to the fact that it costs money and to get away from these costs, mine proprietors and operators parent out strategies to get away and defeat the security law (Laurence 2005). Accidents and loss of existence in South African mines are largely due to negligence in the mining phase (Eweje 2005). This was noted through the use of the security audit conducted in 2009 to decide the tiers of compliance of immoderate random mines in South Africa with the legislative requirements set out in the Safety and Health Act in mines. The audit took place once with the help of using an incident that took place in 2007 where 3200 miners have been trapped underground for forty-two hours (Furter 2009).

2.3. Theoretical Perspective

According to Pandya (2010: 21), a theory is a set of beliefs, assertions, concepts, or propositions developed or devised to supply rationalization to a group of facts or phenomena. It is viewed exactly because of the truth that it has been tested once once more and is consequently broadly accepted. It can be used to furnish rationalization for a secure classification of phenomena or used to make predictions. It is a set of standards built-in thru a sequence of relational statements or a set of interrelated propositions that have been examined and believed to be actual (Pandya 2010).

In this regard, the theories outlined below will be used in the learner's time to provide a clarification of the have an impact on and the relationship between protection controls and manufacturing cost. On the other hand, these theories will be used as pointers for notes and conclusions relevant to the modern study. The following theories will be explained in the study: Normal Accident Theory Via Perrow (1984); High reliability concept through Sagan (1993); Security manipulate cost principle with the help of Son, Melchers, & Kal (2000); and an oblique concept of the price of accident prevention with help (Brody et al., 1990).

2.3.1. Normal Accident Theory

According to the Normal Accident Theory (NAT), accidents are inevitable and therefore regarded as normal (Perrow 1984). Researchers supported this precept and cited that there are no range of counts as tough groups try to forestall and keep away from accidents, accidents will appear constantly (Shrivastava et al., 2009). However, the South African authorities, passing Law no. 29 of 1996 on Mining Health and Safety (Section 2), accept as true with that accidents can be avoided. Accordingly, it requires that the mining employer in the usa comply with the requirements of the Act and have in area security manipulate measures that comply with the hints provided with the help of this Act in order to make certain some protection. (RSA, 1996).

Heblewhite (2009) harassed that mining cannot have any zero possibility for fitness and safety; by means of mining uncertainties. There is constantly the possibility that accidents can be manifested through mining operations. Hence this find out about will determine

whether or not the mine in question helps the concept and does now not have safety measures in region as the concept states that there is nothing that can be achieved to forestall accident occurrences and are consequently considered normal (Cooke & Rohleder 2006).

In the context of this study, normal accident theory explains the patterns of accidents with daily life of humankind. Normal accident theory explains the reliability behind preparedness of mineworkers to ensure human security. This theory is associated with personal and health security determinants of human security. Thus, implies that this theory is so relevant to mining related safety risks and human security.

2.3.2. High Reliability Theory

On the other hand, the High Reliability Theory (HRT) by means of Segan (1993) supported by means of Weick (2004), differs from NAT. According to the theory, if corporations strive harder, motion towards being an accident free machine ought to be facilitated regardless of how tightly coupled and complex the device operates. Reliability refers to the ability to preserve and execute error-free operations. The consequences of the statistics made with the help of Beck and Alford (2008) published that accidents can be slowed down, even in quite unsafe things to do carried out by means of fallible humans. La Porte (2014) argues that to ensure some reliability, the following should be highlighted: Strategic prioritization of security; Careful attention in layout and procedures; Limited degree of error and error learning; Decentralized selection making; Continuing education; and strong cultures that inspire surveillance and response.

Cooke and Rohleder (2006) argue that the success of excessive reliability can be ensured through the use of the following protection: Uncertainty about the causality of accidents; Politicized environments in which incident investigation takes place; the human tendency to cowl up mistakes; Secrecy inside businesses regarding accidents; and Ensuring dedication to security coaching and senior management. Saleh, Marais, Bakolas, and Cowlagi (2010) proposed that while accidents are normal, groups can investigate incidents by way of putting in place a machine to control the frequency and severity of accidents. In addition, Cooke and Rohleder (2006) are used that corporations with controls in the area can learn from incidents by reacting to these incidents via setting preventive measures in the vicinity to

forestall serious accidents from occurring and consequently go from ordinary accident corporations to rather reliable corporations.

In the context of this study, high reliability theory gives explanatory capability of human security to stabilize mining safety risk. Accidents are only controlled if the measures control mining safety risks and this is all along backed by the skills, knowledge and information of mine workers to control heavy accidents to ensure human security.

2.3.3. Safety Control Cost Theory

Son et al. (2000) posit that there is a relationship between safety overall performance and costs. Thus, a theory was once spread that the greater the design, implementation, and protection tiers to achieve, the decrease the fashionable rate inside the organization. To buy the principal safety phases, more costs are incorporated and these charges will be borne by means of the employer.

Therefore, it can be concluded that under a higher security realm, there will be no accidents as the stop end result there will be no expenses associated to accidents. From the findings, studying about will determine whether or not or now not the Colliery in question has protection measures in place to make sure place of work security. It will also figure out whether or not or no longer the implementation and request is perceived or the lack of protective measures to enlarge or decrease production value in the Colliery below review. It will also decide whether or not or not the implementation and the application or the lack of protection manipulate measures is perceived to extend or decrease the production value at the Colliery below review.

2.3.4. Indirect Cost Theory of Accident Prevention

Indirect Cost Theory of Accident Prevention affirms that for each accident that occurs, there are oblique expenses incurred. Indirect expenses are the costs that are incurred via companies due to accidents but can't be directly attributed to a unique accident (Cloete & Marimuthu 2008). Indirect prices are additionally referred to as hidden fees due to the truth that many employers are now not aware of these costs. For this reason, these charges are now not insured and are totally absorbed by way of the employer. Heinrich (1959), who started out

examining accidents at work in the late 1920s, concluded that oblique fees are substantially and often multiples of direct costs triggered via accidents with a frequent share of the fourth. phase (indirect costs / direct costs) (Brody et al. 1990).

It is believed that the sum of oblique costs due to accidents constitutes a probably fruitful source of savings and is therefore possibly to encourage proprietors to invest in preventive measures. For example, 350 disabling accidents in Quebec in 2018 incurred the oblique value in excess of \$1 one hundred per accident and \$2 900 per time loss accident (Brody, et al. 1990).

The four mentioned above theories including normal accident theory, high reliability, safety control cost and indirect cost theory of acceptance. These are all related because both of the theories provide theoretical explanation of controlling accidents in mining sector of Rwanda and global dimension to vocalize the contribution of mining industry on the economy of the country and security of people. They all provide the guidance on how an organization or institutions may mitigate the possibilities of accidents.

2.4 Conceptual framework

Conceptual framework indicates the relationship between independent variable and dependent variable which is represented by mining safety risks and human security, and the intervening variable which is represented by national security and economic growth.

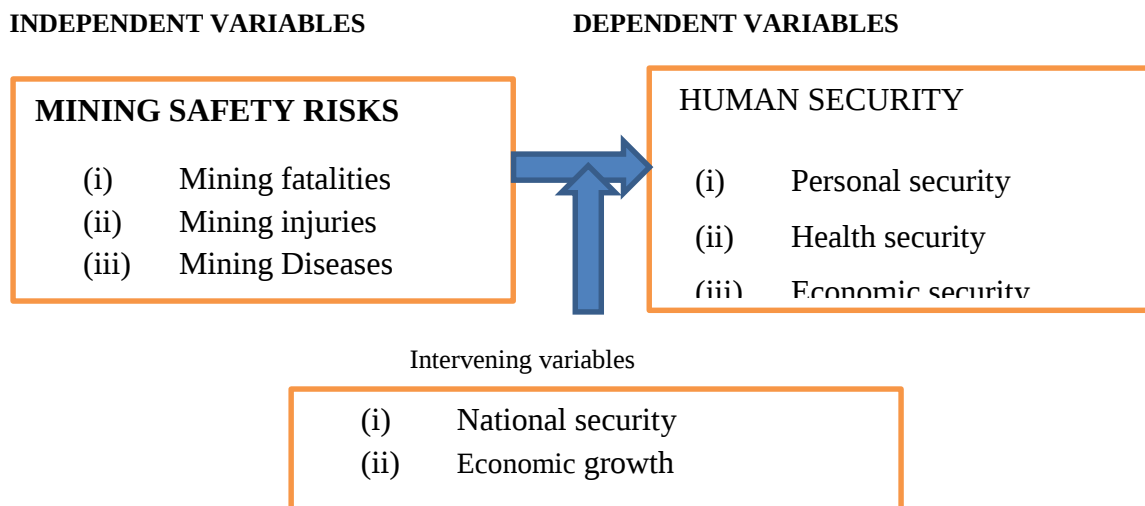


Figure 2.1: Conceptual Framework

Source: Researcher, 2019

Figure 2.1 indicates that the mining safety risks is dependent variable that cause change in the dependent variable represented by human security, and mining safety risks is measured in terms fatal death, permanent injuries and diseases whereas human security is measured in terms of personal security, health security and economic security. While factors such as national security and economic growth are known as intervening variables and may also cause change in dependents variable known as human security when they are not well controlled.

Table 2.1: Operationalization Table

Objectives	Variables	Indicators	Measurement	Methodology
1. To determine the effect of mining safety risks on health security of mine workers in Muhanga District of Rwanda	Mining safety risks: Independent Variable Health security: Dep. Variable	1. Mining fatalities 2. Personal security	✓ Number of Miners died per year ✓ Number of Non-miners died due to mining ✓ Standards of living ✓ Income ✓ Expenditure ✓ Savings ✓ Ubudehe category	Descriptive (capturing both quantitative and qualitative data)
2. To examine the relationship between mining safety risks and economic security of mine workers in Muhanga District of Rwanda	Mining Safety risks: Indep. Variable Economic security: Dep. Variable	3. Mining injuries 4. Health security 5. Mining diseases	✓ Number of Permanent injuries ✓ Number of Temporary injuries ✓ Numbers of Loss of body part/s ✓ Physical fitness ✓ Injury free body ✓ Disease free ✓ Dust / lung diseases ✓ Pollution/ respiratory diseases	Descriptive
3. To establish recommendations to ensure mining safety of mine	Recommendations to mining safety risks: Indep. Variable	4. Economic security	✓ Freedom of choice ✓ Food security ✓ Mining income ✓ Projects got from mining	Descriptive

workers to enhance human security in Muhanga District of Rwanda	Human security: Dependent v	5. National security and economic growth	activities ✓ Contribution of GDP to national economy ✓ Defence power ✓ Diplomatic alliance	
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Source: Primary data, 2019

The table 2.1 indicates that this study is based on three specific objectives which are to determine the effect of mining safety risks on health security of mine workers in Muhanga District of Rwanda, to examine the relationship between mining safety risks and economic security of mine workers in Muhanga District of Rwanda, to establish recommendations to ensure mining safety of mine workers to enhance human security in Muhanga District of Rwanda. The variables of the study are mining safety risks as independent variable, human security as dependent variable that is represented by health security and economic security in objective one and two as indicators, whereas the main measures of the study involve the number of death related to mining to both miners and other individual around the mine sites, standards of live and poverty free measuring personal security; permanent injuries, temporary injuries and loss of body part (s) as measures of mining injuries.

CHAP III: RESEARCH METHODOLOGY

3.1. Research design

This study used a descriptive research structure to consist of qualitative and quantitative information in order to catch meaningful and applicable records on the have an effect on of mining protection risks on human security in Rwanda with the mining enterprise in Muhanga district. Guy (2006) noted that the descriptive disposition of lookup determines and includes combining data with qualitative statistics and quantitative data. The combined approach is used to understand what virtually exists and that comes from the particular use of the impacts of mining security dangers on human safety in Rwanda.

3.2 Target population

According to Odera (2006), the goal populace of statistics is described as all people or elements, be they humans, animals, trees, objects, events, and so on. of a well-defined group. That is, population ability all elements in a well-defined set of values. The goal populace will consist of the full variety of mining employees in Muhanga District who are 186 miners, 24 local leaders and eight mining business enterprise proprietors to enlarge the variety to 218 human beings (Muhanga Statistics Office, 2019).

3.3 Sample design

3.3.1 Sample size

The sample measurement is defined as a group of topics drawn from the entire population in order to be tested or examined in small print and to make a subsequent generalization. A sample is additionally described as representative of the population (Pamela, 2006). Sampling is the approach of using a small range of sentences or parts of a larger populace to draw conclusions about the total population. The will of the sample dimension used to be performed the usage of the machine method.

According to Yamane (1967), the sample size used to be typically decided with the help of the use of the following formulation:

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

$$n = \frac{218}{1 + 218(0.1)^2}$$

$$n = \frac{218}{3.18}$$

$$n = 69$$

Where n= sample size
 N= number of population
 e=Significant Error Term (0.1)

Table 3. 1. Proportional Sample Size Basing on Categories of Respondents

Categories of respondents	Population Size	Sample Size
Mine workers	186	59
Local leader	24	8
Mining company owner	8	2
Total	218	69

Source: Researcher, 2019

3.3.2 Sampling techniques

Sampling strategies refer to the strategies and methods that need to be used whilst choosing the range of respondents from the find out about based populace (Wallen, 2004). He further mentioned that the intentional sampling technique ensures that each aspect of the on hand population should be chosen primarily based on a applicable reason for acquiring the required facts. Thus, the sample of respondents was selected as soon as the usage of the proposed sampling technique. The sample was used with the intention of constituting the respondents relevant to the study, which are 25 interviewees interviewed collectively with 8 local people, 2 business enterprise owners and 15 mining people who run greater experienced human teams and human beings. of 7 years in the mining enterprise to gather more qualitative

files and narratives and the closing 44 mining workers acquired a questionnaire and returned after filling them out.

3.4 Data collection strategies and instruments

3.4.1. Questionnaire

The questionnaire as an instrument of statistical collection was once used to attain information from the respondents. This approach helped the lookup access the most essential facts the usage of semi-administered structured questionnaires with the questions totally closed to the miners.

3.4.2. Guide to interviews

The researcher also used facts from the interview to reap some records from respondents in this learn about on the influence of mining security hazards on human protection in Rwanda. During the facts series process, the researcher interviewed almost 15 miners due to the truth that he had overheard dialogue with the miners and cited that the miners could have many records on the risks of mining security and human safety as in contrast to their leaders-owners of mining entrepreneurs. and crew chiefs. The interviewed mineworkers are the people near the mine site and those who have spent more than 7 years in the mine site.

3.4.3. Secondary data

Secondary information was accrued from textbooks, countrywide documentaries, journals, internet and annual reports. The records to be accrued consist of each qualitative and quantitative data.

3.4.4. Primary data

A questionnaire was used due to the fact that it is convenient to monitor and analyze the data of this, and an interview was once performed to gather data from gurus in the commercial enterprise team who answered questions associated to the effect of the risks of

mining and human protection. Interviews had been the key gadgets to accumulate this vital data.

3.5. Data collection procedures

In this study, the fundamental records were amassed after using the Questionnaire formulated to accumulate data from mining workers, even though about 15 mining people who seemed to have much information about mining safety related risks and human security were given interview guide for the safe of the leaders as company like company owners. I got interested in them when I had one narrating the history and how he came in mining and the years he spent in mining. He mentioned he has spent more than 40 years in mining activities and more mine workers take him as their role models he is at the same time a team leader he is always working with the team.

Interview guide was designed for 10 people including 8 local leaders and 2 company owners. However, the researcher added more 15 respondents who are mine workers and team leaders to have more qualitative records and accumulate a complete file on the effect of mining security risks on human security in Rwanda which was administered in three degrees (before, throughout and after) administration.

3.6. Reliability and validity

Reliability is a measure of how consistent the results are. The check used to be finished to take a look at if the questionnaire is understandable at the equal stage through capability of the respondents, if the questions are prepared or no longer so that they get the same answer. There are also different procedures to take a seem at the answer, such as school reviews and neighborhood administration. Prior to the distribution of the questionnaires, these have been cautiously checked thru the researcher to see if the accumulated data used to be associated with the topic. The questionnaire was as soon as tested to see if it would be terrific for respondents to understand. The researcher consulted the supervisor while compiling the questionnaire, colleagues and experts in the discipline who had been engaged in it to make sure the validity and reliability.

3.7. Data analysis procedures

Data analysis is based on the goals that are applied on the method used to collect the records from the field, the key factors being on the effect of mining protection hazards on human protection in Rwanda to the approach used for research especially in their interview and questionnaire, inserting into account specific mastering objectives, such as analyzing the contribution of mining areas to safety risks, looking at the relationship between protection dangers and human security, analyzing the contribution of area strategies mining to safety risks.

Their answers had been in tables and compare them to the answers acquired from respondents on how the trainings attended had been organized. Data analysis is a practice in which row facts is ordered and organized so that beneficial facts can be extracted from it (Gall, Gall & Borg, 2007). The data gathered thru questionnaires, used to be equipped in education for contrast through editing, coding, categorizing and introducing statistical packages for SPSS analysis packages for social science analysis (SPSS) which had been used to produce frequencies, descriptive and inferential. information to use conclusions and generalizations of the population. Correlation evaluation used to be used as a statistical device to highlight the relationship between lookup variables.

3.8. Ethical Matters

The findings of the study used to be made taking into account the ethical values of the research, respecting the behaviors and grasp of human beings, respecting their bond and different consideration how to inform them before pleasurable them to reply the questions. The researcher used to meet with respondents from the respective mine sites. In addition, the records supplied thru the respondents had been treated with wonderful confidentiality and anonymity, and the University of Rwanda's introductory letter helped with ethical issues.

CHAP IV: PRESENTATION, ANALYSIS AND INTERPRETATION OF FINDINGS

This chapter four gives conclusions and lookup debates involving the demographic characteristics of the respondents, the opinions and perceptions of the respondents on the effect of mining safety dangers on the fitness protection of mine employees in the Muhanga district of the Rwanda: The relationship between the dangers for mining security and the financial protection of mining employees in the Muhanga district of Rwanda and suggestions for making sure mining protection for mining humans to enhance human protection in the Muhanga district of Rwanda. The whole range of sixty-nine respondents was once used to find out the which means of all respondents at a one hundred percentage price on the very wide opinions and perceptions related to the impact of mining safety dangers on humans. the safety of mine personnel in Muhanga district of Rwanda and all the data are entered in the descriptive facts and the correlation tables.

4.1. Data analysis

The researcher has the opinions and perceptions of the respondents in the form of descriptive records tables and they include both socio-demographic characteristics related data of respondents, the effect of mining safety risks on health security of mineworkers in Muhanga District, the relationship between mining safety risks and economic security of mineworkers in Muhanga, and the recommendations to ensure mining safety of mineworkers to enhance human security in Muhanga District.

4.1.1. Respondents' socio-economic characteristics

Table 4. 1: Gender of Respondents

Sex	Frequency	Percent
Male	55	79.7
Female	14	20.3
Total	69	100.0

Source: Primary Data, 2020

The study results in Table 4.1 indicates that 55 (79.7%) of total respondents are male while 14 (20.3%) of total respondents are female. Hence, this study shows a big number of people working in mining industry are males and as well it shows that mining industry in Muhanga District is gender sensitive where also women get opportunities to generate incomes from mining activities.

Table 4. 2: Social Status of respondents

Social Status	Frequency	Percent
Single	15	21.7
Married	39	56.5
Divorced	15	21.7
Total	69	100.0

Source: Primary Data, 2020

The results in Table 4.2 indicates that 39 (56.5%) of total respondents are married, 15 (21.7%) of total respondents are single and 15 (21.7%) of total respondents are divorced. Thus, indicates that a big number of people working in mining industry are married and they have families to feed.

Table 4. 3: Educational Background of Respondent

Educational level	Frequency	Percent
No formal	12	17.4
Primary	43	62.3
Secondary	8	11.6
University	6	8.7
Total	69	100.0

Source: Primary Data, 2020

The results in Table 4.3 indicates that 43 (62.3%) of total respondents are primary leaver level of education, 12 (17.4%) of total respondents do not have formal educational level, 8 (11.6%) of total respondents have only secondary school educational level and 6

(8.7%) have university degree level of education. Hence, these results indicate that a big number of people working in mining industry have primary level of education.

Table 4. 4: Working Experience in Mining Sector

Working Experience	Frequency	Percent
Below 5 years	3	4.3
5-10 years	55	79.7
Above 10 Years	11	15.9
Total	69	100.0

Source: Primary Data, 2020

The results in Table 4.4 indicates that 55 (79.7%) of total respondents have 5 to 10 years of working experience in mining industry, 11 (15.9%) of total respondents have above 10 years of working experience in mining industry, 3 (4.3%) of total respondents have below 5 years of working experience in mining industry. Hence, the results show that a big number of respondents have necessary information because they have 5 to 10 years of working in mining industry.

The results have indicated that most of the respondents have confirmed that they have worked in mining industry between 5 – 10 years. However, in an interview conducted with the second interviewee I met, he mentioned that he was working in these mine sites for more than 40 years. He stated in his words:

I was just born here on this hill and my father too was working for Germans to extract wolfram and cassitelite within these hills. Accidents were there by that time and are still here. So, in case of accidents were there during my father's time and they are here even today. However, there are some changes in number though there is still a long way to go. Another, point to mention is that my father told me that during colonial master the mineworkers were registered and well known but today everyone can work in mining industry which keeps it to be more informal and most of the people do not have long working years of experience in this sector because it is still informal. If it becomes formal sector all the employees will be registered and get all necessities to facility them to work freely in this sector and other people will even like it more because it strengthens the economy faster compared to other sectors.

4.1.2. Effect of mining safety risks on health security of mine workers in Muhanga District of Rwanda

Table 4. 5: Experience of mining safety related risk

Have you experienced any mining safety risky?	Frequency	Percent
Yes	43	62.3
No	26	37.7
Total	69	100.0

Source: Primary Data, 2020

The results in Table 4.5 indicates that 43 (62.3%) of total respondents have experienced mining safety related risks during their works whereas only 26 (37.7%) of total respondents did not experience any safety related risk during their works. Thus, the results indicate that a big number.

Table 4. 6: Mining safety risks

Types of Mining safety risks	Frequency	Percent
Mining fatality	4	5.8
Severe injury	5	7.2
Loss of body part	3	4.3
Minor injuries	52	75.4
Respiratory diseases	3	4.3
Lung diseases	2	2.9
Total	69	100.0

Source: Primary Data, 2020

The results in Table 4.6 indicates that 52 (75.4%) of respondents affirmed that minor injuries are most frequent mining safety risks, followed by severe injuries that stand at 5 (7.2%) of total respondents, mining fatalities stand at 4 (5.8%) of total respondents, loss of body parts stand at 3 (4.3%) of total respondents, respiratory diseases stand at 3 (4.3%) of

respondents and lung diseases stand at 2 (2.9%) of total respondents. The first interviewee of this study stated that:

I was born here with most of my friends that we work together, I have heard people that mine sites have fallen on and die but most of them are those who do illegal mining. However, the serious issues that we have is respiratory diseases not only in mine workers also in neighboring people most during dry season and the face mask that we use are very few and sometimes are used again without being washed. I would say that people die in mining sites but they are rare cases that I have experienced compared to respiratory diseases but people do not go to the health centers and hospital because they take such issues as common or simple issues of coughing.

Thus, the results in table 4.6. indicates that the high frequent mining safety risk in Muhanga District is minor injuries while in the interview conducted the interviewee showed that he would affirm respiratory diseases as the main mining related issue. As the same the study of Akabzaa and Darimani (2001) on mining health related issues and development of mining industry asserted that pollution caused by quarrying and blasting in mines increases not only the dust particles in the air and the surrounding environment, but also promotes the spread of toxic chemicals that result from blasting include cyanide and sulfur dioxide, which are all very harmful to the body and cause respiratory diseases.

Table 4. 7: Company done enough to protect mineworkers

Do companies protect their works ?	Frequency	Percent
Yes	58	84.1
No	11	15.9
Total	69	100.0

Source: Primary Data, 2020

The results in Table 4.7 indicates that 58 (84.1%) of total respondents have affirmed that company does enough to protect mineworkers against mining related risks while only 11 (15.9%) of total respondents did not affirm that company does enough to protect mineworkers against mining related risks. Thus, indicate that a big number of the mineworkers are well protected during their mining activities.

The results in Table 4.7 indicates that a big number of respondents are well protected during their mining activities. However, one of the interviewee of this study have mentioned that he works here because he does have anywhere else to work arguing that they are not protected enough and he stated in his own words:

I started to work in mining industry as an illegal miner. But, the time I have to enter abandoned mine sites and extract my minerals and sell them on black market and I was really getting good money because I managed to construct myself a house at my 21 years and I have two cows from illegal mining. As I continued to go to meetings, local leaders had to tell as that most of the people who get accidents and even die are illegal miners. It was true, a big number of them are illegal miners because entering abandoned sites, rivers and mine sites during the night was very risky and I looked for a job in company and I started working like other. However, I have only seen one difference or two, maybe it is because we work during the day and with other mineworkers because there is some people amongst who work without PPE and even enter deep down in the dark hole without hope of coming back. No way that I can mention that we are safe enough. However, there is a big difference, since the time I left illegal mining I have never experience injury though every week I had to be in injury but continue to go there. Today, I work hoping to go back home because I am with the people even if accident happens they dig until they remove the victims there compared to the time I would die and nobody would know I was die in the mining pit or hole extracting minerals.

Table 4. 8: Tools and Equipment in Mining industry

Types of tools	Frequency	Percent
PPE	40	58.0
Walk talkies	4	5.8
Helmets	8	11.6
BA in case of emergency	5	7.2
first aid Tool kit	8	11.6
Health and safety signs at mine site	4	5.8
Total	69	100.0

Source: Primary Data, 2020

The findings in Table 4.8 indicates that 40 (58.0%) of total respondents use personal protective equipment during their activities of mining, 8 (11.6%) of total respondents' wear helmets during their activities of mining, 8 (11.6%) of respondents use first aid kit during their activities at mine site, 5 (7.2%) of respondents use breathing apparatus during their activities at mine site 4 (5.8%) of total respondents use walk talkies in their daily activities at mining site and 4 (5.8%) of respondents use health and safety signs at mine sites. Thus, the results indicate that a big number of mineworkers wear personal protective equipment during mining activities.

In an interview with one respondent, he was given different information to the use of Breathing Apparatus in case of emergency. Though, the above table indicate that 7, 2% of mineworkers use BA during their mining activities at mine site. He stated in his own words:

I have spent more than 7 years working in this sector of mining. I have seen several incidents and accidents that happen here in mine sites and even participate in rescuing people who were trapped in the mine pit. We spent the whole night digging with Fire Bridge Rescue Team of Rwanda National Police, Local Leaders, people from mining inspection unit at head offices in Kigali and Rwanda Defense Force. However, I only have seen Breathing Apparatus but the time and I have never seen it again. We rescue those mineworkers who were trapped in the mine pit and ambulances were there with medical personnel and they took them at hospital as they were 3 mineworkers. But, one of them die and they said he died because he has lacked oxygen to breath. During our rescue activity, we rescue them and we did not know that he has died but we knew later and he was my co-workers. I cannot mention that we are not secured but were not secured enough and what I see human security will keep be threaten by incidents and accidents until the government and mining sector take a step ahead to fully protect mineworkers with all necessary equipment to mitigate accidents. On my behalf, I would recommend rescue team and medical personnel to be always near the mine sites during mining activities and to sometimes close mine sites in periods of heavy rain because that case happened in early May in 2016 when soil was soft due to rain.

Table 4. 9: Always wearing relevant Protective Gears

Do workers use protective gears?	Frequency	Percent
Yes	62	89.9
No	7	10.1
Total	69	100.0

The results in Table 4.9 indicate that 62 (89.9%) of total respondents affirm that they always wear relevant protective gears during their mining activities whereas 7 (10.1%) of total respondents didn't affirm that they wear relevant protective gears during activities of mining. Thus, implies that most of the mineworkers have relevant protective gears to use in the activities of mining.

The results in Table 4.9 indicates that a big number of mineworkers wear relevant protective gears during the activities of mining. However, in an interview with one mineworker surprisingly he mentioned that he has never worn personal protective equipment even helmet during his activities in mining. He mentioned in his words:

I spent a month here working in mine site, before coming here I was working in Kigali in Construction Company we usually wear helmets to protect ourselves during construction activities. When, I came here and I asked for a job I had to buy some equipment to use from my pocket as somebody who have got a job. I ask for our team leader for other equipment he said that I will get next week and I kept asking and now it is a month over. However, I work very well and I have not experience any injury but it is better to have protective equipment because I am worried of my life if any incident happen what may happen to me, I am still waiting I believe I will get them but I cannot spend the second month without them I would rather go back to Kigali to look for another employment.

Table 4. 10: Severe Injury or diseases related to mining

People experienced mine injuries and related diseases	Frequency	Percent
None	51	73.9
Below 5 people	11	15.9
5-10 people	4	5.8
Above 10 people	3	4.3
Total	69	100.0

Source: Primary Data, 2020

The results in Table 4.10 indicates that 51 (73.9%) of total respondents have seen nobody experiencing severe injury or disease related to mining, while 11 (15.9%) of respondents indicate that they have seen below 5 people who have experience such severe

injuries and diseases related to mining, 4 (5.8%) of respondents have asserted that they have seen 5 to 10 people who have experienced severe injuries and diseases related to mining and 3 (4.3%) of respondents who have seen above 10 people who have experience such severity of injury and diseases related to mining safety risks. Thus, this implies that there is less cases of severity of injuries and diseases but still they occur.

In the above presented findings reveals that 73.9 mineworkers have never seen nobody experience severe injury or disease related to mining. However, one of the interviewee has mentioned that almost all of them they do cough during dry season. He stated that:

We used to cough during dry season due to dust from here in mine sites though I was not a mineworker. My dad was hospitalized and died over blood circulation pressure and respiratory diseases and he was a veteran from this mining sector. He worked here during and after the colonial rule, when he died I decided that I will not do his job and I came here because there is no any other job that I can do but now I like mining industry because I am getting medical insurance for my family and my last born is now doing her senior four. I am sure if she finishes I will go home and leave this job. We cannot know that we are sick until we get sick. Fortunately, for a short period though it is not short as such I managed to build in the trading center far from here so that at least my family should not continue to breath the dust from these mine sites.

Table 4. 11: Mining related fatalities

Number of people	Frequency	Percent
None	57	82.6
Below 5 people	8	11.6
5-10 people	2	2.9
Above 10 people	2	2.9
Total	69	100.0

Source: Primary Data, 2020

The results in Table 4.11 indicates that 57 (82.6%) of total respondents have seen nobody experiencing fatality related to mining, while 8 (11.6%) of respondents indicate that they have seen below 5 people who have experience such fatality related to mining, 2 (2.9%) of respondents have asserted that they have seen 5 to 10 people who have experienced fatalities related to mining and 3 (4.3%) of respondents who have seen above 10 people who

have experience fatalities related to mining safety risks. Thus, this implies that there is less cases of death fatalities but still they occur.

The fifth interviewee, I ask questions he mentioned that he lost a friend and co-worker in mining activities and he felt he could not get back to mining industry but after six months he saw that he doesn't have anywhere else to go and he can back to mining activities. Thus, implies that it is true that there are some cases of mining related death fatalities in mining industry. He stated in his own words:

I worked here in mining activities for almost 9 years. In 2017, I have spent 6 years in this profession and I have never seen anybody who died despite of minor injuries from mine sites. I have seen myself together with my friends, the mine site coming down and we call for our two co-workers who were in the pit to come back, they didn't hear us and we remembered we use ropes to tell them that there is a danger we pulled the rope and they as they were coming one of them we hit and he directly died. An ambulance came and took him to the hospital and they took us to make statements at police and we entered home, a day after we buried him. Government stopped the pit for over a year and after a year people went to extract minerals in it and they still and no any other accident happened in it.

Table 4. 12: Sort of alert in case of emergency to your co- worker

Do companies have alert devices?	Frequency	Percent
Yes	59	85.5
No	10	14.5
Total	69	100.0

Source: Primary Data, 2020

The results in Table 4.12 indicate that 59 (85.5%) of total respondents affirm that they have sort of alert in case of emergency to co-workers who are working whereas 10 (14.5%) of total respondents didn't affirm that that they have sort of alert in case of emergency to co-workers who are working. Thus, implies that most of the mineworkers have sort of alert in case of emergency to co-workers who are working in the mine site.

Table 4. 13: Adequate equipment, materials and personal protective equipment

Do workers use protective equipment during mining?	Frequency	Percent
Agree	59	85.5
Disagree	8	11.6
Neutral	2	2.9
Total	69	100.0

Source: Primary Data, 2020

The results in Table 4.13 reveal that 59 (85.5%) of respondents agreed that they use adequate equipment, materials and personal protective equipment during activities of mining, 8 (11.6%) of the total respondents disagree that they do not use adequate equipment, materials and personal protective equipment during activities of mining whereas only 2 (2.9%) didn't want to reveal anything regarding the use of adequate equipment, materials and personal protective equipment during activities of mining. Thus, implies that even if adequate equipment, materials and personal protective equipment are used during activities of mining but they are not enough to satisfy the number of mineworkers that worker in mining industry of Muhanga District.

In an interview with the company owner, he mentioned that they provide all necessary equipment to the mineworkers to ensure their safety and increase their production. Though, the results presented in the table above indicate that the provided materials and equipment are not enough to satisfy the number of mineworkers at mine site. He stated in his words:

I have spent more than 5 years in this career and I have a mining company that I represent. I have come here when the number of mineworkers who have the necessary materials and equipment to help them in terms of safety and production were really very fewer but so far within these five years. We have no mineworker who doesn't have the necessary tools, equipment and material to use in this industry, we saw that our employees cannot afford them we buy them and those who have them themselves we do hire them for our services. I am sure we shall do better even we have a long journey to go to ensure zero incident in mining sector though it is still hard because we cannot predict accidents. But, we are making sure that even if accident and incident occur no life is lost or injured because we are planning to put more measure to ensure safety and production of mineworkers.

Table 4. 14: Safety materials provided by company

Do companies provide enough safety eqpt?	Frequency	Percent
Agree	52	75.4
Disagree	13	18.8
Neutral	4	5.8
Total	69	100.0

Source: Primary Data, 2020

The results in Table 4.14 prove that 52 (75.4%) of respondents agreed that they use safety materials provided by their companies during activities of mining, 13 (18.8%) of the total respondents disagree that they do not use safety materials provided by their companies during activities of mining whereas only 2 (2.9%) didn't want to reveal anything regarding the use of safety materials provided by their companies during activities of mining. Thus, implies that even if safety materials provided by their companies are used during activities of mining but they are not enough to satisfy the number of mineworkers that worker in mining industry of Muhanga District.

In an interview with a female team leader, she mentioned that she makes sure that nobody goes to the mine pit without safety material provided by the company, though she still has one mineworker who does not have all the safety equipment. She stated:

I am team leader and this my six year in this industry, after finishing my senior six I had to accompany my dad who had worked here for several years. My dad retired from working here and I continued to come when I made a month coming here after the retirement of my dad I felt am not going to work again in mining. I stopped and after a week before even going to take my salary my boss came with other two boys that we had finished senior six together. They convinced me to go back and boss promised me to make me a team leader and he paid me my salary. I went back and I had to work with my fellow mineworkers now with the other friends of mine we have finished university and two of us we are still working in mining industry. I work as if I do not have a degree because I have a degree from the money I earned in mining and I have bought even land and cows. I got a job far from home and I refused to go

because I like my team who whoever boss comes they make me team leader and I do prioritize the safety of my fellow mine workers through ensuring that nobody goes to the pit without protective gears.

Table 4. 15: My company provides notice on all health and safety measures

Are companies provide health and safety measures?	Frequency	Percent
Agree	63	91.3
Disagree	4	5.8
Neutral	2	2.9
Total	69	100.0

Source: Primary Data, 2020

The results in Table 4.15 indicate that 63 (91.3%) of respondents agreed that their companies provide notice on all health and safety measures that are used during activities of mining, 4 (5.8%) of the total respondents disagree that their companies do not provide notice on all health and safety measures that are used during activities of mining whereas only 2 (2.9%) didn't want to reveal anything regarding the contribution of their companies in providing notices on all health and safety measures that are used during activities of mining. Thus, implies that even if companies provide notice on all health and safety measures that are used during activities of mining but they are not enough to provide such health and safety measures that can halt the number of health and safety risks in in mining industry of Muhanga District.

In an interview conducted with a company owner stated that he provides notice on all health and safety measures to all his mineworkers in regular meetings of every month and he talks about them to each team he works with every day he comes to work. He stated in his words:

Safety notices matter much in this profession because it is too much expose to accidents, I always tell my mineworkers to take precaution and ensure safety whenever they are here at mine sites. They have named me names that I do not know because they know I do not wish to see anybody without his PPE, they know that I send them back when they are not wearing PPE while here at mine site. I know they do not like doings of coming to work in different

teams because they feel the team I am going to work in is cursed but whatever I do is for their safety not my production. I know that they do produce even if I am in Kigali and rest or do anything else but I do not want to hear that any incident has happened to my mine site when I am in Kigali. Safety for mineworker is more precious than production because mines are always there in land and people will keep extract them but life loss is a big loss to the company, family and country at large.

Table 4. 16: Safety induction, orientation and refresher courses are conducted by my company

Are regular safety inductions conducted?	Frequency	Percent
Agree	50	72.5
Disagree	14	20.3
Neutral	5	7.2
Total	69	100.0

Source: Primary Data, 2020

The results in Table 4.16 show that 50 (72.5%) of respondents agreed that safety induction, orientation and refresher courses are conducted by their company before starting activities of mining, 14 (20.3%) of the total respondents disagree that safety induction, orientation and refresher courses are not conducted by their company before starting activities of mining whereas only 5 (7.2%) didn't want to reveal anything regarding safety induction, orientation and refresher courses conducted by their company before starting activities of mining. Thus, implies that even if companies conduct safety induction, orientation and refresher courses before starting activities of mining but they are not enough to equip knowledge and skills that make them able to halt health and safety risks in in mining industry of Muhanga District.

Table 4. 17: Co- workers in my company ensure the safety of fellow worker

Do workers protect each other while mining?	Frequency	Percent
Agree	63	91.3

Disagree	5	7.2
Neutral	1	1.4
Total	69	100.0

Source: Primary Data, 2020

The results in Table 4.17 reveal that 63 (91.3%) of total respondents agreed that co-workers in their companies ensure the safety of fellow worker during activities of mining, 5 (7.2%) of the total respondents disagree that co-workers in their companies do not ensure the safety of fellow worker during activities of mining whereas only 1 (1.4%) didn't want to reveal anything regarding whether their co-workers in their companies ensure the safety of fellow worker during activities of mining. Thus, implies that even if that co-workers in their companies ensure the safety of fellow worker during activities of mining but they are not enough ensured to halt health and safety risks in in mining industry of Muhanga District.

4.1.3 Relationship between mining safety risks and economic security of mine workers in Muhanaga District

Table 4. 18: Causes of the persisting mining safety risks

Causes	Frequency	Percent
Lack of PPE	46	66.7
Lack of safety signs at site	14	20.3
Ignorance	5	7.2
Carelessness	2	2.9
poor supervision	2	2.9
Total	69	100.0

Source: Primary Data, 2020

The results in Table 4.18 indicates that 46 (66.7%) of total respondents affirmed that lack of PPE is the main cause of the persisting mining safety risks, 14 (20.3%) of total respondents affirmed that lack of safety signs at mine site are also among the cause of persisting mining safety risks, 5 (7.2%) of total respondents have also affirmed ignorance as another cause of persisting mining safety risks, 2 (2.9%) of total respondents have also affirmed carelessness

as another cause of persisting mining safety risks and 2 (2.9%) of total respondents have also affirmed poor supervision as another cause of persisting mining safety risks. Thus, the big number of respondents have affirmed lack of personal protective equipment.

Table 4. 19: Measures being undertaken at your mine site to ensure Safety

Measures taken to ensure safety	Frequency	Percent
Provision of PPE to each miner	61	88.4
Closing and filling abandoned site	2	2.9
Doing professional training	1	1.4
Hiring experts	1	1.4
Proper signage and following the latest safety rules	4	5.8
Total	69	100.0

Source: Primary Data, 2020

The results in Table 4.19 indicates that 61 (88.4%) of total respondents affirmed provision of PPE to each mineworker as the main measure undertook to ensure safety of mine site, 4 (5.8%) of respondents affirmed that proper signage and following the latest safety rules as another measure undertook to ensure safety of mine site, 2 (2.9%) of total respondents affirmed that closing and filling abandoned site as another measure undertook to ensure safety of mine sites, 1 (1.4%) of total respondents affirmed doing professional training as another measure undertaken to ensure safety of mine site. Thus, the big number of respondents have affirmed that provision of personal protective equipment to each mineworker is the main measure that is being undertaken to ensure safety at their mine sites. The interview conducted with one local leader have mentioned that he is born in the same vicinity of mining extraction. But, this period is the first period that he has gone in the inspection with inspection unit from Kigali and found that almost all the sites have signage and mineworkers with safety equipment.

I am among the fewer local leaders who was born from here. I also have worked in mine sites during my holidays when I was a student, but I have never seen equipment like the ones I have seen during the last inspection we conducted in July 2019. Though, I have not seen the results from the inspection we conducted with the mining inspection unit that I was accompanying but

I think mining sector is making an improvement to ensure safety of mine workers in Muhanga. This has assured me that a lot of measures are being undertaken to ensure the safety of mine workers because he have seen that there now no abandoned sites that are not closed and the cases of injuries reported too were very fewer. In my area, we had no case of death though I am not publishing the report of the inspection unit. I hope may be in other areas too there were no mining related death reports.

Table 4. 20: Management responds quickly to safety concern

Responses to safety concern	Frequency	Percent
Agree	54	78.3
Disagree	10	14.5
Neutral	5	7.2
Total	69	100.0

Source: Primary Data, 2020

The results in Table 4.20 indicate that 54 (78.3%) of total respondents agreed management responds quickly to safety concern, 10 (14.5%) of the total respondents disagreed that management does not respond quickly to safety concern, whereas only 5 (7.2%) didn't want to reveal anything regarding whether management responds quickly to safety concern, Thus, implies that even if management responds quickly to safety concern, but they are not enough that management is really concerned of the mineworkers' safety in mining industry of Muhanga District.

Table 4. 21: Relationship between mining safety risks with economic security

Relationship between mining safety with economic security	Frequency	Percent
Agree	66	95.7
Disagree	2	2.9
Neutral	1	1.4

Total	69	100.0
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Source: Primary Data, 2020

The results in Table 4.21 revealed that 66 (95.7%) of total respondents agreed there is relationship between mining safety risks with economic security, 2 (2.9%) of the total respondents disagreed that there is no relationship between mining safety risks with economic security, whereas only 1 (1.4%) didn't want to reveal anything regarding relationship between mining safety risks with economic security. Thus, implies a big number of respondents affirmed that there is a relationship between mining safety risks and economic security in Muhanga District.

4.1.4. The recommendations to ensure mining safety of mineworkers to enhance human security in Muhanga District.

Table 4. 22: Training of mine workers

Training of mine workers	Frequency	Percent
strongly agree	51	73.9
Agree	9	13.0
Neutral	4	5.8
Disagree	3	4.3
strongly Disagree	2	2.9
Total	69	100.0

Source: Primary Data, 2020

The findings in Table 4. 22 prove that 51 (73.9%) of respondents have strongly agreed that training of mine workers is a key element of concern during mining inspection, 9 (13.0%) of respondents have agreed training of mine as another element that is inspected during mining inspections, 4 (5.8%) of respondents have decided to say nothing regarding whether training of mineworkers is among the key element of concern during mining inspection, 3 (4.3%) of respondents have disagreed that training mineworkers is among the key element of concern during mining inspection, 2 (2.9%) have strongly disagreed that training

mineworkers is among the key element of concern during mining inspection. Hence, it implies that training of mine workers is a key element of concern during mining inspection.

Table 4. 23: Professionalism of mine workers

Professionalism of mine workers	Frequency	Percent
Strongly Agree	62	89.9
Agree	2	2.9
Neutral	1	1.4
Disagree	3	4.3
Strongly Disagree	1	1.4
Total	69	100.0

Source: Primary Data, 2020

The findings in Table 4. 23 prove that 62 (89.9%) of respondents have strongly agreed that professionalism of mineworkers is a key element of concern during mining inspection, 3 (4.3%) of respondents have disagreed professionalism of mineworkers is a key element of concern during mining inspection, 2 (2.9%) of respondents have agreed that professionalism of mineworkers is a key element of concern during mining inspection, 1 (1.4%) of respondents have decided to say nothing regarding whether professionalism of mineworkers is a key element of concern during mining inspection, 1 (1.4%) have strongly disagreed that professionalism of mineworkers is a key element of concern during mining inspection. Hence, it implies that professionalism of mineworkers is a key element of concern during mining inspection.

In an interview conducted with a local leader he mentioned that professionalism of mineworkers is the key to mitigate the mining related risks and ensure the safety and human security of the mineworkers. He stated in his own words:

I have never got luck to work in mine industry but basing on what I have seen during my visits, most of the accidents that happen in mining activities are related to carelessness and unprofessionalism of mineworkers because sometimes I do surprise visits and I go to the mine site and I see some people who are not wearing their clothes and helmets that they use. There is one time I wrangled with one of the company owners whom the employees have said he doesn't provide safety materials needed at the mine site and I know they do not train them on

how to extract minerals in professional way so that they do not pollute our rivers. I always argue with company owners why they do not train themselves and their mine workers in the field of mining activities. However, I have seen some mineworkers will be professional as they continue to work in this sector because they number of the people with PPE has highly increase I have made a surprise visit and saw that almost everyone has his PPE, though two of them were not wearing them even if they had. So, more trainings and awareness are need in this sector to make it professional.

Table 4. 24: Mining health and safety signage at mine site

Are safety signage available At mine sites?	Frequency	Percent
Strongly agree	52	75.4
Agree	9	13.0
Neutral	4	5.8
Disagree	3	4.3
Strongly Disagree	1	1.4
Total	69	100.0

Source: Primary Data, 2020

The findings in Table 4. 24 prove that 52 (75.4%) of respondents have strongly agreed that mining health and safety signage at mine site is a key element of concern during mining inspection, 9 (13.0%) of respondents have agreed that mining health and safety signage at mine site is a key element of concern during mining inspection, 4 (5.8%) of respondents have decided to say nothing regarding whether mining health and safety signage at mine site is a key element of concern during mining inspection, 3 (4.3%) of respondents have disagreed that mining health and safety signage at mine site is a key element of concern during mining inspection, 1 (1.4%) have strongly disagreed that mining health and safety signage at mine site is a key element of concern during mining inspection. Hence, it implies that mining health and safety signage at mine site is a key element of concern during mining inspection.

Table 4. 25: Safety of mine site

Inspection of mine site safety	Frequency	Percent
Strongly agree	61	88.4

Agree	2	2.9
Neutral	1	1.4
Disagree	2	2.9
Strong Disagree	3	4.3
Total	69	100.0

Source: Primary Data, 2020

The findings in Table 4. 25 indicate that 61 (88.4%) of respondents have strongly agreed that safety of mine site is a key element of concern during mining inspection, 3 (4.3%) of respondents have strongly disagreed safety of mine site is a key element of concern during mining inspection, 2 (2.9%) of respondents have agreed that safety of mine site is a key element of concern during mining inspection, 2 (2.9%) have disagreed that safety of mine site is a key element of concern during mining inspection, 1 (1.4%) of respondents have decided to say nothing regarding whether safety of mine site is a key element of concern during mining inspection. Hence, it implies that safety of mine site is a key element of concern during mining inspection.

Table 4. 26: Mining seasons and climate change

Do climate change is concerned during mine inspection?	Frequency	Percent
Strongly Agree	49	71.0
Agree	8	11.6
Neutral	4	5.8
Disagree	3	4.3
Strongly Disagree	5	7.2
Total	69	100.0

Source: Primary Data, 2020

The findings in Table 4. 26 show that 49 (71.0%) of respondents have strongly agreed that mining seasons and climate change is a key element of concern during mining inspection, 8 (11.6%) of respondents have agreed that mining seasons and climate change is a key element of concern during mining inspection, 5 (7.2%) have strongly disagreed that mining seasons and climate change is a key element of concern during mining inspection, 4 (5.8%) of

respondents have decided to say nothing regarding whether mining seasons and climate change is a key element of concern during mining inspection, 3 (4.3%) of respondents have disagreed that mining seasons and climate change is a key element of concern during mining inspection,. Hence, it implies that mining seasons and climate change is a key element of concern during mining inspection.

Table 4. 27: Environmental degradation

Do inspectors check environmental degradation?	Frequency	Percent
Strong Agree	61	88.4
Agree	2	2.9
Neutral	1	1.4
Disagree	4	5.8
Strongly Disagree	1	1.4
Total	69	100.0

Source: Primary Data, 2020

The findings in Table 4. 27 prove that 61 (88.4%) of respondents have strongly agreed that environmental degradation is a key element of concern during mining inspection, , 4 (5.8%) of respondents have disagreed that environmental degradation is a key element of concern during mining inspection, 2 (2.9%) of respondents have agreed that environmental degradation is a key element of concern during mining inspection, 1 (1.4%) of respondents have decided to say nothing regarding whether environmental degradation is a key element of concern during mining inspection, and 1 (1.4%) have strongly disagreed that environmental degradation is a key element of concern during mining inspection. Hence, it implies that environmental degradation is a key element of concern during mining inspection.

In an interview with one local leader, he mentioned that mining leaves the environment in a very poor state because rivers and pullulated and trees and glasses are cutting were they are conducting mining activities. He mentioned:

The first time I came to work here I was really ignored with how the environment was treated, there was almost five abandoned sites that were not closed I proposed we should conduct my first Umuganda to close the abandoned sites and we did not close all of the but within like three months we had at least made a big contribution. I proposed to the mining company

owners to fence their areas of operation. Some did and other did not, I took my time and I called all of them and we agreed, I hope now there is no unclosed abandoned site, we are working and taking care of the environment while extracting minerals because those mine sites that degrade the environment we do charge them fees or close them or even give them to other, it can also reach the level of reporting them to not renew their licenses because they do not care about the environment. So, environment degradation really it is high in areas of extraction compared to other areas but we do plant trees to avoid environmental degradation.

Table 4. 28: Health of mine workers

Inspection of the health of Mine workers	Frequency	Percent
Strongly Agree	52	75.4
Agree	9	13.0
Neutral	4	5.8
Disagree	3	4.3
Strongly Disagree	1	1.4
Total	69	100.0

Source: Primary Data, 2020

The findings in Table 4. 28 reveal that 52 (75.4%) of respondents have strongly agreed that health of mineworkers is a key element of concern during mining inspection, 9 (13.0%) of respondents have agreed that health of mineworkers is a key element of concern during mining inspection, 4 (5.8%) of respondents have decided to say nothing regarding whether health of mineworkers is a key element of concern during mining inspection, 3 (4.3%) of respondents have disagreed that health of mineworkers is a key element of concern during mining inspection, 1 (1.4%) have strongly disagreed that health of mineworkers is a key element of concern during mining inspection. Hence, it implies that health of mineworkers is a key element of concern during mining inspection.

Table 4. 29: Health insurance of mine workers

Do the companies provide health insurance to their workers?	Frequency	Percent
Strongly Agree	58	84.1
Agree	4	5.8

Neutral	3	4.3
Disagree	3	4.3
Strongly Disagree	1	1.4
Total	69	100.0

Source: Primary Data, 2020

The findings in Table 4. 29 prove that 58 (84.1%) of respondents have strongly agreed that health insurance of mineworkers is a key element of concern during mining inspection, 4 (5.8%) of respondents have agreed that health insurance of mineworkers is a key element of concern during mining inspection, 3 (4.3%) of respondents have decided to say nothing regarding whether health insurance of mineworkers is a key element of concern during mining inspection, 3 (4.3%) of respondents have disagreed that health insurance of mineworkers is a key element of concern during mining inspection, 1 (1.4%) have strongly disagreed that health insurance of mineworkers is a key element of concern during mining inspection. Hence, it implies that health insurance of mineworkers is a key element of concern during mining inspection.

Table 4. 30: Supervision of mining team

Supervision of mining team	Frequency	Percent
Strongly agree	48	69.6
Agree	12	17.4
Neutral	5	7.2
Disagree	3	4.3
Strongly disagree	1	1.4
Total	69	100.0

Source: Primary Data, 2020

The findings in Table 4. 30 show that 48 (69.6%) of respondents have strongly agreed that supervision of mining team is a key element of concern during mining inspection, 12 (17.4%) of respondents have agreed that supervision of mining team is a key element of concern during mining inspection, 5 (7.2%) of respondents have decided to say nothing

regarding whether supervision of mining team is a key element of concern during mining inspection, 3 (4.3%) of respondents have disagreed that supervision of mining team is a key element of concern during mining inspection, 1 (1.4%) have strongly disagreed that supervision of mining team is a key element of concern during mining inspection. Hence, it implies supervision of mining team is a key element of concern during mining inspection.

Table 4. 31: Safety procedure documentation

Safety procedure documentation	Frequency	Percent
Strongly Agree	59	85.5
Agree	3	4.3
Neutral	1	1.4
Disagree	5	7.2
Strongly Agree	1	1.4
Total	69	100.0

Source: Primary Data, 2020

The findings in Table 4. 31 prove that 59 (85.5%) of respondents have strongly agreed that safety procedure documentation is a key element of concern during mining inspection, 5 (7.2%) of respondents have disagreed that safety procedure documentation is a key element of concern during mining inspection, 3 (4.3%) of respondents have agreed that safety procedure documentation is a key element of concern during mining inspection, 1 (1.4%) of respondents have decided to say nothing regarding whether safety procedure documentation is a key element of concern during mining inspection, , 1 (1.4%) have strongly disagreed that safety procedure documentation is a key element of concern during mining inspection. Hence, it implies that safety procedure documentation is a key element of concern during mining inspection.

Table 4. 32: Latest standards of health and safety in mining sector

Use of latest standards of health and safety in mining	Frequency	Percent
Strong Agree	50	72.5
Agree	9	13.0

Neutral	4	5.8
Disagree	2	2.9
strongly Disagree	4	5.8
Total	69	100.0

Source: Primary Data, 2020

The findings in Table 4. 32 prove that 50 (72.5 %) of respondents have strongly agreed that latest standards of health and safety in mining sector is a key element of concern during mining inspection, 9 (13.0%) of respondents have agreed that latest standards of health and safety in mining sector is a key element of concern during mining inspection, 4 (5.8%) of respondents have decided to say nothing regarding whether latest standards of health and safety in mining sector is a key element of concern during mining inspection, 4 (5.8%) have strongly disagreed that latest standards of health and safety in mining sector is a key element of concern during mining inspection, 2 (2.9%) of respondents have disagreed that latest standards of health and safety in mining sector is a key element of concern during mining inspection. Hence, it implies that latest standards of health and safety in mining sector is a key element of concern during mining inspection.

Table 4. 33: Number of closed abandoned mine site

Do abandoned mine sites cause mine accidents?	Frequency	Percent
Strongly Agree	62	89.9
Agree	2	2.9
Neutral	1	1.4
Disagree	3	4.3
Strongly Disagree	1	1.4
Total	69	100.0

Source: Primary Data, 2020

The findings in Table 4. 33 prove that 62 (89.9%) of respondents have strongly agreed that number of closed abandoned mine site is a key element of concern during mining inspection, 3 (4.3%) of respondents have disagreed that number of closed abandoned mine site is a key element of concern during mining inspection 2 (2.9%) of respondents have

agreed that number of closed abandoned mine site is a key element of concern during mining inspection, 1 (1.4%) of respondents have decided to say nothing regarding whether number of closed abandoned mine site is a key element of concern during mining inspection, , 1 (1.4%) have strongly disagreed that number of closed abandoned mine site is a key element of concern during mining inspection. Hence, it implies that number of closed abandoned mine site is a key element of concern during mining inspection.

Table 4. 34: Mineworker should not be subjected to unreasonable mining safety risk

Mineworker should not be subjected to unreasonable mining safety risk	Frequency	Percent
Strongly Agree	53	76.8
Agree	9	13.0
Neutral	4	5.8
Disagree	2	2.9
Strongly Disagree	1	1.4
Total	69	100.0

Source: Primary Data, 2020

The study findings in Table 4.34 prove that 53 (76.8%) of respondents strongly agreed that mineworkers should not be subjected to unreasonable mining safety risk, 9 (13.0%) of respondents have agreed that mineworkers should not be subjected to unreasonable mining safety risk, 4 (5.8%) of respondents have kept neutral on the point regarding whether mineworkers should not be subjected to unreasonable mining safety risk, 2 (2.9%) of respondents have disagreed that mineworkers should not be subjected to unreasonable mining safety risk, 1 (1.4%) of respondents have strongly disagree that mineworkers should not be subjected to unreasonable mining safety risk. Thus, implies that a big number of respondents have strongly agreed that mineworkers should not be subjected to unreasonable mining safety risk.

Table 4. 35: Mining companies and government should give professional training

Provision of training	Frequency	Percent
Strongly Agree	7	10.1

Agree	28	40.6
Neutral	32	46.4
Disagree	2	2.9
Total	69	100.0

Source: Primary Data, 2020

The study findings in Table 4.35 showed that 32 (46.4%) of respondents kept neutral on the point regarding mining companies and government should give professional training to the mineworkers, 28 (40.6%) of respondents agreed that mining companies and government should give professional training to the mineworkers, 7 (10.1%) of respondents strongly agreed that mining companies and government should give professional training to the mineworkers, 2 (2.9%) of respondents disagreed that mining companies and government should give professional training to the mineworkers. Thus, implies that a big number of respondents have kept neutral on the point regarding mining companies and government should give professional training to the mineworkers.

Table 4. 36: Mining health and Safety signage should be placed at mine site

Safety signage to be place at mine sites	Frequency	Percent
Strongly agree	62	89.9
Agree	2	2.9
Neutral	1	1.4
Disagree	3	4.3
Strongly Disagree	1	1.4
Total	69	100.0

Source: Primary Data, 2020

The study findings in Table 4.36 reveal that 62 (89.9%) of respondents strongly agreed that mining health and safety signage should be placed at mine site, 3 (4.3%) of respondents have disagreed that mining health and safety signage should be placed at mine site, 2 (2.9%) of respondents have agreed that mining health and safety signage should be placed at mine site, 1 (1.4%) of respondents have strongly disagreed that mining health and safety signage should be placed at mine site, 1 (1.4%) of respondents have kept neutral regarding the point that mining health and safety signage should be placed at mine site. Thus,

implies that a big number of respondents have strongly agreed that mining health and safety signage should be placed at mine site.

Table 4. 37: Conducting periodic review of mining safety

To conduct periodic review Of mining safety	Frequency	Percent
Strongly Agree	61	88.4
Agree	2	2.9
Neutral	1	1.4
Disagree	2	2.9
Strongly Disagree	3	4.3
Total	69	100.0

Source: Primary Data, 2020

The study findings in Table 4.34 prove that 61 (88.4%) of respondents strongly agreed that conducting periodic review of mining safety is recommended measure to ensure safety of mineworkers, 3 (4.3%) of respondents have strongly disagreed that conducting periodic review of mining safety is recommended measure to ensure safety of mineworkers, 2 (2.9%) of respondents have agreed that conducting periodic review of mining safety is recommended measure to ensure safety of mineworkers, 2 (2.9%) of respondents have disagreed that conducting periodic review of mining safety is recommended measure to ensure safety of mineworkers, 1 (1.4%) of respondents have kept neutral on the point regarding conducting periodic review of mining safety is recommended measure to ensure safety of mineworkers. Thus, implies that a big number of respondents have strongly agreed that conducting periodic review of mining safety is recommended measure to ensure safety of mineworkers.

Table 4. 38: Protecting environment and closing abandoned sites

Environmental protection	Frequency	Percent
Strongly Agree	59	85.5
Agree	3	4.3
Neutral	1	1.4
Disagree	4	5.8

Strongly Disagree	2	2.9
Total	69	100.0

Source: Primary Data, 2020

The results in Table 4.38 indicate that 59 (85.5%) of respondents strongly agreed that protecting environment and closing abandoned sites is recommended measure to ensure safety of mineworkers, 4 (5.8%) of respondents have disagreed that protecting environment and closing abandoned sites is recommended measure to ensure safety of mineworkers, 3 (4.3%) of respondents have agreed that protecting environment and closing abandoned sites is recommended measure to ensure safety of mineworkers, 2 (2.9%) of respondents have strongly disagreed that protecting environment and closing abandoned sites is recommended measure to ensure safety of mineworkers, 1 (1.4%) of respondents have kept neutral regarding the point that protecting environment and closing abandoned sites is recommended measure to ensure safety of mineworkers. Thus, implies that a big number of respondents have strongly agreed that protecting environment and closing abandoned sites is recommended measure to ensure safety of mineworkers.

Table 4. 39: Provision of emergency equipment and means of alert

Provision of emergency equipment	Frequency	Percent
strongly Agree	60	87.0
Agree	2	2.9
Neutral	3	4.3
Disagree	2	2.9
Strongly Disagree	2	2.9
Total	69	100.0

Source: Primary Data, 2020

The study findings in Table 4.39 prove that 60 (87.0%) of respondents strongly agreed that provision of emergency equipment and means of alert is recommended measure to ensure safety of mineworkers, 3 (4.3%) of respondents have kept neutral on the point regarding whether provision of emergency equipment and means of alert is recommended measure to

ensure safety of mineworkers, 2 (2.9%) of respondents have agreed that provision of emergency equipment and means of alert is recommended measure to ensure safety of mineworkers, 2 (2.9%) of respondents have disagreed that provision of emergency equipment and means of alert is recommended measure to ensure safety of mineworkers, 2 (2.9%) of respondents have strongly disagree that provision of emergency equipment and means of alert is recommended measure to ensure safety of mineworkers. Thus, implies that a big number of respondents have strongly agreed that provision of emergency equipment and means of alert is recommended measure to ensure safety of mineworkers.

Table 4. 40: Provision of life insurance

Provision of life insurance	Frequency	Percent
Strongly Agree	61	88.4
Agree	3	4.3
Neutral	1	1.4
Disagree	2	2.9
Strongly Disagree	2	2.9
Total	69	100.0

Source: Primary Data, 2020

The study findings in Table 4.40 prove that 61 (88.4%) of respondents strongly agreed that provision of life insurance is recommended measure to ensure safety of mineworkers, 3 (4.3%) of respondents have agreed that provision of life insurance is recommended measure to ensure safety of mineworkers, 2 (2.9%) of respondents have disagreed provision of life insurance is recommended measure to ensure safety of mineworkers, 2 (2.9%) of respondents have strongly disagree that provision of life insurance is recommended measure to ensure safety of mineworkers, 1 (1.4%) of respondents have kept neutral on the point regarding whether provision of life insurance is recommended measure to ensure safety of mineworkers,. Thus, implies that a big number of respondents have strongly agreed that provision of life insurance is recommended measure to ensure safety of mineworkers.

Table 4. 41: Use of technology in mining

Use of technology in mining	Frequency	Percent
Strongly Agree	61	88.4
Agree	1	1.4
Neutral	3	4.3
Disagree	2	2.9
Strongly Disagree	2	2.9
Total	69	100.0

Source: Primary Data, 2020

The study findings in Table 4.41 prove that 61 (88.4%) of respondents strongly agreed that use of technology in mining industry is recommended measure to ensure safety of mineworkers, 3 (4.3%) of respondents have kept neutral on the point regarding whether use of technology in mining industry is recommended measure to ensure safety of mineworkers, 2 (2.9%) of respondents have disagreed that use of technology in mining industry is recommended measure to ensure safety of mineworkers, 2 (2.9%) of respondents have strongly disagree that use of technology in mining industry is recommended measure to ensure safety of mineworkers, 1 (1.4%) of respondents have agreed that use of technology in mining industry is recommended measure to ensure safety of mineworkers. Thus, implies that a big number of respondents have strongly agreed that use of technology in mining industry is recommended measure to ensure safety of mineworkers.

Table 4. 42: Provision of safety notices in all mine site

Provision of safety notices in all mine site	Frequency	Percent
Strongly Agree	61	88.4
Agree	2	2.9
Neutral	1	1.4
Disagree	3	4.3

Strongly Disagree	2	2.9
Total	69	100.0

Source: Primary Data, 2020

The study findings in Table 4.42 prove that 61 (88.4%) of respondents strongly agreed that provision of safety notices in all mine sites is recommended measure to ensure safety of mineworkers, 3 (4.3%) of respondents have disagreed that provision of safety notices in all mine sites is recommended measure to ensure safety of mineworkers, 2 (2.9%) of respondents have strongly disagree that provision of safety notices in all mine sites is recommended measure to ensure safety of mineworkers, 2 (2.9%) of respondents have agreed that provision of safety notices in all mine sites is recommended measure to ensure safety of mineworkers, 1 (1.4%) of respondents have kept neutral on the point regarding whether provision of safety notices in all mine sites is recommended measure to ensure safety of mineworkers. Thus, implies that a big number of respondents have strongly agreed that provision of safety notices in all mine sites is recommended measure to ensure safety of mineworkers.

In the interview conducted with one local leaders have mentioned that they do give report to other local leaders about the status of safety notices in all mine sites though they do not know how far the reports reach and the feedback of the reports. He stated in his word:

I am always called to report the status of safety notices and incidents that happen in the mine sites of the area that I head. I always go there twice in month to get information. However, what I see our leaders should take this as serious because you can see signage and safety notices in the mine sites but the abandoned sites they do not mark them. I would advise that all the places that are undertaking or undertook mining activities should be marked to ensure safety of our people and properties. I attended on the other hill where the cow had fallen in a pit and nobody who knew that that pit was there but some of the miners have said that they extract minerals there but they left the company and the company is no longer licensed to extract. Though, that company is no longer working but working companies should be reminded to close their abandoned sites in times of terminating their works.

Table 4. 43: Adoption of latest standards of mining safety

Adoption of latest standards of mining safety	Frequency	Percent
Strongly Agree	59	85.5

Agree	2	2.9
Neutral	3	4.3
Disagree	2	2.9
Strongly Disagree	3	4.3
Total	69	100.0

Source: Primary Data, 2020

The study findings in Table 4.43 show that 59 (85.5%) of respondents strongly agreed that adoption of latest standards of mining safety is recommended measure to ensure safety of mineworkers, 3 (4.3%) of respondents have strongly disagree that adoption of latest standards of mining safety is recommended measure to ensure safety of mineworkers, 3 (4.3%) of respondents have kept neutral on the point regarding whether adoption of latest standards of mining safety is recommended measure to ensure safety of mineworkers, 2 (2.9%) of respondents have agreed that adoption of latest standards of mining safety is recommended measure to ensure safety of mineworkers, 2 (2.9%) of respondents have disagreed that adoption of latest standards of mining safety is recommended measure to ensure safety of mineworkers. Thus, implies that a big number of respondents have strongly agreed that adoption of latest standards of mining safety is recommended measure to ensure safety of mineworkers.

Table 4. 44: Provision of PPE to all miners

Provision of PPE to all miners	Frequency	Percent
Strongly Agree	61	88.4
Agree	2	2.9
Neutral	2	2.9
Disagree	2	2.9
Strongly Disagree	2	2.9
Total	69	100.0

Source: Primary Data, 2020

The study findings in Table 4.44 prove that 61 (88.4%) of respondents strongly agreed that provision of PPE to all mineworkers is recommended measure to ensure safety of mineworkers, 2 (2.9%) of respondents have agreed that provision of PPE to all mineworkers is recommended measure to ensure safety of mineworkers, 2 (2.9%) of respondents have kept neutral on the point regarding whether provision of PPE to all mineworkers is recommended measure to ensure safety of mineworkers, 2 (2.9%) of respondents have disagreed that provision of PPE to all mineworkers is recommended measure to ensure safety of mineworkers, 2 (2.9%) of respondents have strongly disagree that provision of PPE to all mineworkers is recommended measure to ensure safety of mineworkers. Thus, implies that a big number of respondents have strongly agreed that provision of PPE to all mineworkers is recommended measure to ensure safety of mineworkers.

Table 4. 45: Correlation analysis between predictors of mining safety risks

Predictors of mining safety risks		Mining Fatalities	Mining Injuries	Mining Diseases
Mining Fatalities	Pearson Correlation	1	.478**	.481**
	Sig. (2-tailed)		.000	.000
	N	69	69	69
Mining Injuries	Pearson Correlation	.478**	1	.743**
	Sig. (2-tailed)	.000		.000
	N	69	69	69
Mining Diseases	Pearson Correlation	.481**	.743**	1
	Sig. (2-tailed)	.000	.000	
	N	69	69	69

** . Correlation is significant at the 0.01 level (2-tailed).

Source: Primary Data, 2020

The results in Table 4.45 reveal that there is a relationship between mining fatalities and mining injuries ($p=.478$ and $\text{sig}=.000$), between mining fatalities and mining diseases ($p=.481$ and $\text{sig}=.000$), between mining injuries and mining diseases ($p=.743$ and $\text{sig}=.000$). Hence, it implies that there is a relationship between predictors of mining safety risks in Muhanga District.

Table 4. 46: Correlation analysis between dimensions of human security

Dimensions of human security		Personal Security	Health Security	Economic Security
Personal Security	Pearson Correlation	1	.812**	.992**
	Sig. (2-tailed)		.000	.000
	N	69	69	69
Health Security	Pearson Correlation	.812**	1	.850**
	Sig. (2-tailed)	.000		.000
	N	69	69	69
Economic Security	Pearson Correlation	.992**	.850**	1
	Sig. (2-tailed)	.000	.000	
	N	69	69	69

** . Correlation is significant at the 0.01 level (2-tailed).

Source: Primary Data, 2020

The findings in Table 4.45 prove that there is a relationship between personal security and health security ($p=.812$ and $\text{sig}=.000$), personal security and economic security ($p=.992$ and $\text{sig}=.000$), health security and economic security ($p=.850$ and $\text{sig}=.000$). Thus, implies that there is a relationship between dimensions of human security.

Table 4. 47: Correlation analysis between mining safety risks and human security

		Mining Fatalities	Mining Injuries	Mining Diseases	Personal Security	Health Security	Economic Security
Mining Fatalities	Pearson Correlation	1	.478**	.481**	.438**	.470**	
	Sig. (2-tailed)		.000	.000	.000	.000	.000
	N	69	69	69	69	69	69
Mining Injuries	Pearson Correlation	.478**	1	.743**	.458**	.429**	.481**
	Sig. (2-tailed)	.000		.000	.000	.000	.000
	N	69	69	69	69	69	69
Mining Diseases	Pearson Correlation	.481**	.743**	1	.445**	.636**	.468**
	Sig. (2-tailed)	.000	.000		.000	.000	.000
	N	69	69	69	69	69	69
Personal Security	Pearson Correlation	.438**	.458**	.445**	1	.812**	.992**
	Sig. (2-tailed)	.000	.000	.000		.000	.000
	N	69	69	69	69	69	69
Health Security	Pearson Correlation	.470**	.429**	.636**	.812**	1	.850**
	Sig. (2-tailed)	.000	.000	.000	.000		.000
	N	69	69	69	69	69	69

Economic Security	Pearson Correlation	.461**	.481**	.468**	.992**	.850**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	
	N	69	69	69	69	69	69

** . Correlation is significant at the 0.01 level (2-tailed).

Source: Primary Data, 2020

The results in Table 4.45 prove that there is a relationship between mining fatalities and mining injuries ($p=.478$ and $\text{sig}=.000$), between mining fatalities and mining diseases ($p=.481$ and $\text{sig}=.000$), between mining injuries and mining diseases ($p=.743$ and $\text{sig}=.000$), personal security and health security ($p=.812$ and $\text{sig}=.000$), personal security and economic security ($p=.992$ and $\text{sig}=.000$), health security and economic security ($p=.850$ and $\text{sig}=.000$), between mining fatalities and personal security ($p=.438$ and $\text{sig}=.000$), between mining fatalities and health security ($p=.470$ and $\text{sig}=.000$), between mining fatalities and economic security ($p=.461$), between mining injuries and personal security ($p=.458$ and $\text{sig}=.000$), between mining injuries and health security ($p=.429$ and $\text{sig}=.000$), between mining injuries and economic security ($p=.481$ and $\text{sig}=.000$), between mining diseases and personal security ($p=.445$ and $\text{sig}=.000$), between mining diseases and health security ($p=.636$ and $\text{sig}=.000$) and between mining diseases and economic security ($p=.468$ and $\text{sig}=.000$). Thus, there is a relationship between predictors of mining safety risks and dimensions of human security in Muhanga District.

4.2. Summary and discussion of findings

The results prove that there is a relationship between mining fatalities and mining injuries ($p=.478$ and $\text{sig}=.000$), between mining fatalities and mining diseases ($p=.481$ and $\text{sig}=.000$), between mining fatalities and personal security ($p=.438$ and $\text{sig}=.000$), between mining fatalities and health security ($p=.470$ and $\text{sig}=.000$), between mining fatalities and economic security ($p=.461$ and $\text{sig}=.000$), between mining injuries and personal security ($p=.458$ and $\text{sig}=.000$), between mining injuries and health security ($p=.429$ and $\text{sig}=.000$), between mining injuries and economic security ($p=.481$ and $\text{sig}=.000$), between mining diseases and personal security ($p=.445$ and $\text{sig}=.000$), between mining diseases and health security ($p=.636$ and $\text{sig}=.000$) and between mining diseases and economic security ($p=.468$ and $\text{sig}=.000$).

In the case of previous studies, the study of Groves and Radomsky (2008) has some similar findings to this study because it has indicated that mines gear economic security of the country but it is also attached to loss of life among people and enhance physical injuries, fatalities and diseases related to mining (Groves & Radomsky, 2008). Other studies have shown that mining is considered to be a dangerous occupation based on the fact that mine workers have to face relatively hazardous work environments due to heat and gases that they are exposed to compared to workers in other industries (Kecojevic & Komljenovic, 2007). As the current studies also indicated that 43 (62.3%) of total respondents have experienced mining safety related risks during their works, 52 (75.4%) of respondents affirmed that minor injuries are most frequent in mining works. However, the study has indicated some other different findings proving that 51 (73.9%) of total respondents have seen nobody experiencing severe injury or disease related to mining, and 57 (82.6%) of total respondents have seen nobody experiencing fatality related to mining.

In the case of previous studies, in the mines one can die at any time during the eight hours due to an earth fall, a gas explosion or extreme heat. However, due to the hard life of remote villages where unemployment and hunger are the norm, working in the mines is an obligation (Baleni 2011). The previous studies have also indicated that accidents thousands of miners are sent home every year because of inability to perform duties after sustaining injuries (Ndlovu 2008). Hence, the study has indicated different results revealing that 46 (66.7%) of total respondents affirmed that lack of PPE is the main cause of the persisting mining safety risks, 61 (88.4%) of total respondents affirmed provision of PPE to ensure safety of mineworkers, and 66 (95.7%) of total respondents agreed there is relationship between mining safety risks with economic security.

4.3 Conclusion and recommendations to ensure mining safety of mine workers to enhance human security in Muhanga District of Rwanda

The findings presented in this chapter four shows that a big number of mineworkers have experienced cases of mining safety related risks during the works. As per the qualitative data presented into narratives in this study, the same opinion comes to the persistence of mining safety related risks that hits the lives of mineworkers, some die, other get injuries and diseases. Though, mineworkers dignify mining sectors as the profession that earn them better standards of living but they asserted in narratives that mineworkers earn a lot of money to the

company owners so that it should not continue to look like an informal sector. Whereby, mineworkers do not get pensions and other allowances to help their families in case of mining related death.

To ensure mining safety of mine workers to enhance human security in Muhanga District of Rwanda, this study recommends that government and mining sector should ensure the full and potential safety of mineworkers through provision of personal protective equipment, provision of emergency medical and rescue team to assist in case of emergency, provision of medical insurance and medical allowance to the mineworkers, putting in place social security fund to support the mineworkers in pension period or retirement, registering professional mineworkers and training them so that they full benefit from mining sector, and ensure proper signage at mine sites and adopt latest standards of mining safety and use of technology in mining sector.

CHAP V: MAJOR FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

Chapter five of this study dealt with major findings of the study, conclusions and recommendations drawn from the study findings of the effect of mining safety risks on human security of mineworkers in Muhanga District. This study was limited on its variables such as mining safety risks and human security with their dimensions such as mining fatalities, mining injuries and mining diseases; and personal security, health security and economic security.

5.1. Major findings of the study

5.1.1. The effect of mining safety risks on health security of mineworkers

The results indicate that 43 (62.3%) of total respondents have experienced mining safety related risks during their works, 52 (75.4%) of respondents affirmed that minor injuries are most frequent mining safety risks, 58 (84.1%) of total respondents have affirmed that company does enough to protect mineworkers against mining related risks, 40 (58.0%) of total respondents use personal protective equipment during their activities of mining, 62 (89.9%) of total respondents affirm that they always wear relevant protective gears during their mining activities, 51 (73.9%) of total respondents have seen nobody experiencing severe injury or disease related to mining, and 57 (82.6%) of total respondents have seen nobody experiencing fatality related to mining.

The results of the study also indicates that 59 (85.5%) of total respondents affirm that they have sort of alert in case of emergency to co-workers who are working, 59 (85.5%) of respondents agreed that they use adequate equipment, materials and personal protective equipment during activities of mining, 52 (75.4%) of respondents agreed that they use safety materials provided by their companies during activities of mining, 63 (91.3%) of respondents agreed that their companies provide notice on all health and safety measures that are used during activities of mining, 50 (72.5%) of respondents agreed that safety induction, orientation and refresher courses are conducted by their company before starting activities of mining, and 63 (91.3%) of total respondents agreed that co- workers in their companies ensure the safety of fellow worker during activities of mining.

5.1.2. The relationship between mining safety risks and economic security of mineworkers

The results indicate that 46 (66.7%) of total respondents affirmed that lack of PPE is the main cause of the persisting mining safety risks, 61 (88.4%) of total respondents affirmed provision of PPE to each mineworker as the main measure undertaken to ensure safety of mine site, 54 (78.3%) of total respondents agreed that management responds quickly to safety concern and 66 (95.7%) of total respondents agreed there is relationship between mining safety risks with economic security.

The results prove that there is a relationship between mining fatalities and mining injuries ($p=.478$ and $\text{sig}=.000$), between mining fatalities and mining diseases ($p=.481$ and $\text{sig}=.000$), between mining fatalities and personal security ($p=.438$ and $\text{sig}=.000$), between mining fatalities and health security ($p=.470$ and $\text{sig}=.000$), between mining fatalities and economic security ($p=.461$), between mining injuries and personal security ($p=.458$ and $\text{sig}=.000$), between mining injuries and health security ($p=.429$ and $\text{sig}=.000$), between mining injuries and economic security ($p=.481$ and $\text{sig}=.000$), between mining diseases and personal security ($p=.445$ and $\text{sig}=.000$), between mining diseases and health security ($p=.636$ and $\text{sig}=.000$) and between mining diseases and economic security ($p=.468$ and $\text{sig}=.000$).

5.1.3. The recommendations to ensure mining safety of mineworkers to enhance human security

The findings have proved that 62 (89.9%) of respondents have strongly agreed that professionalism of mineworkers is a key element of concern during mining inspection, and 62 (89.9%) of respondents strongly agreed that mining health and safety signage should be placed at mine site, 52 (75.4%) of respondents have strongly agreed that mining health and safety signage at mine site is a key element of concern during mining inspection, 61 (88.4%) of respondents have strongly agreed that safety of mine site is a key element of concern during mining inspection, 49 (71.0%) of respondents have strongly agreed that mining seasons and climate change is a key element of concern during mining inspection, 61 (88.4%) of respondents have strongly agreed that environmental degradation is a key element of concern during mining inspection, 51 (73.9%) of respondents have strongly agreed that training of mine workers is a key element of concern during mining inspection, and 52

(75.4%) of respondents have strongly agreed that health of mineworkers is a key element of concern during mining inspection.

The findings have also shown that 58 (84.1%) of respondents have strongly agreed that health insurance of mineworkers is a key element of concern during mining inspection, 48 (69.6%) of respondents have strongly agreed that supervision of mining team is a key element of concern during mining inspection, 59 (85.5%) of respondents have strongly agreed that safety procedure documentation is a key element of concern during mining inspection, 50 (72.5 %) of respondents have strongly agreed that latest standards of health and safety in mining sector is a key element of concern during mining inspection, 62 (89.9%) of respondents have strongly agreed that number of closed abandoned mine site is a key element of concern during mining inspection and 53 (76.8%) of respondents strongly agreed that mineworkers should not be subjected to unreasonable mining safety risk, 32 (46.4%) of respondents kept neutral on the point regarding mining companies and government should give professional training to the mineworkers, and 28 (40.6%) of respondents agreed that mining companies and government should give professional training to the mineworkers.

The study findings also proved that 61 (88.4%) of respondents strongly agreed that conducting periodic review of mining safety is recommended measure to ensure safety of mineworkers, 59 (85.5%) of respondents strongly agreed that protecting environment and closing abandoned sites is recommended measure to ensure safety of mineworkers, 60 (87.0%) of respondents strongly agreed that provision of emergency equipment and means of alert is recommended measure to ensure safety of mineworkers, 61 (88.4%) of respondents strongly agreed that provision of life insurance is recommended measure to ensure safety of mineworkers, 61 (88.4%) of respondents strongly agreed that use of technology in mining industry is recommended measure to ensure, 61 (88.4%) of respondents strongly agreed that provision of safety notices in all mine sites is recommended measure to ensure safety of mineworkers, 59 (85.5%) of respondents strongly agreed that adoption of latest standards of mining safety is recommended measure to ensure safety of mineworkers, and 61 (88.4%) of respondents strongly agreed that provision of PPE to all mineworkers is recommended measure to ensure safety of mineworkers.

5.2. Conclusion

Most the empirical literatures of the previous done related studies in the field of mining safety risks and human security revealed that mining is considered to be a dangerous occupation based on the fact that mineworkers have to face relatively hazardous work to environments due to heat and gases that they are exposed to compared to workers in other industries (Kecojevic & Komljenovic, 2007). The same findings of this study have indicated that 59 (85.5%) of total respondents affirm that they have sort of alert in case of emergency to co-workers who are working, 59 (85.5%) of respondents agreed that they use adequate equipment, materials and personal protective equipment during activities of mining, 52 (75.4%) of respondents agreed that they use safety materials provided by their companies during activities of mining. However, in the case of this study the results have shown that 51 (73.9%) of total respondents have seen nobody experiencing severe injury or disease related to mining, and 57 (82.6%) of total respondents have seen nobody experiencing fatality related to mining.

Most of the literatures have indicated that mines gear economic security of the country but it is also attached to loss of life among people and enhance physical injuries, fatalities and diseases related to mining (Groves & Radomsky, 2008). In the case of this study, the results have shown that there is a relationship between mining fatalities and personal security ($p=.438$ and $\text{sig}=.000$), between mining fatalities and health security ($p=.470$ and $\text{sig}=.000$), between mining fatalities and economic security ($p=.461$), between mining injuries and personal security ($p=.458$ and $\text{sig}=.000$), between mining injuries and health security ($p=.429$ and $\text{sig}=.000$), between mining injuries and economic security ($p=.481$ and $\text{sig}=.000$), between mining diseases and personal security ($p=.445$ and $\text{sig}=.000$), between mining diseases and health security ($p=.636$ and $\text{sig}=.000$) and between mining diseases and economic security ($p=.468$ and $\text{sig}=.000$). Hence, these results showed that there is a relationship between the mining safety risks and human security because all calculated p-values are under 0.01 level of significance.

Therefore, the results of the study recommend that there should be conducting periodic review of mining safety, protecting environment and closing abandoned sites, provision of emergency equipment and means of alert, provision of life insurance, use of technology in mining industry, provision of safety notices in all mine sites, adoption of latest standards of

mining safety provision of PPE to all mineworkers, mineworkers should not be subjected to unreasonable mining safety risk, mining companies and government should give professional training to the mineworkers and mining companies and government should give professional training to the mineworkers.

5.3. Recommendations

5.3.1. Recommendation to mineworkers

The researcher would like to recommend to the mineworkers to wear regularly Personal Protective Equipment during activities of mining, mineworkers should also close abandoned sites to avoid accidents of the surrounding people, mineworkers should use emergency equipment for alert in case of mining related accidents, mineworkers should use adopt latest standards of mining safety to ensure their well-being, mineworkers should also have health insurance to ensure that in case of accidents they are not subjected to minor mining health related risks.

5.3.2. Recommendation to company owners

The researcher would also recommend to company owners to provide Personal Protective Equipment, provision of emergency equipment to all employees of the company, conducting periodic review of mining safety, provision of life insurance to all company employees, use of technology in mining industry while extracting mines, provision of safety notices in all mine sites, mineworkers should not be subjected to unreasonable mining safety risk, mining companies and government should give professional training to the mineworkers and mining companies and government should give professional training to the mineworkers.

5.3.3. Recommendation to government

The researcher would also like to recommend to the government to do regular inspections to all operating companies the country, to inspect the safety of all mine sites in the country, to conduct periodic review of mining safety, to protect environment and close abandoned sites, recommend to all companies to use emergency alert in case of danger, to recommend to all

operating companies to provide safety notices in all mine sites and adopt of latest standards of mining safety.

5.3.4. Recommendation for further studies

The researcher would like to recommend further studies to be done in the field of the study to assess the role of mining safety risks on human security of mineworkers in Rwanda, to examine the impact of mining health safety and personal security in Rwanda, to determine the impact of mining industry on economic security of Rwanda, and to establish the relationship between economic growth and national security in Rwanda.

REFERENCES

BOOKS

1. Davis, A., 2016. *Hearing in adults: The prevalence and distribution of hearing impairment and reported hearing disability in the MRC Institute of Hearing Research's National Study of Hearing*. London: Whurr Publishers.
2. De Soto, E. (2015). *Mining Health and Safety in Mining Economies*. Moskva: Catallaxy.
3. Heinrich, H.W., 1959. *Industrial accident prevention; a scientific approach 1959*. McGraw-Hill.
4. Kula, E., 2014. Agriculture and the environment. In *Economics of Natural Resources, the Environment and Policies* (pp. 127-143). Springer, Dordrecht.
5. Madigan, L. and Gamble, N.C., 1991. *The second rape: Society's continued betrayal of the victim*. Macmillan Pub Co.
6. Perrow, C., 2011. *Normal accidents: Living with high risk technologies-Updated edition*. Princeton university press.
7. Van Teeffelen, J., 2012. The EU raw materials policy and mining in Rwanda. *Amsterdam: Evert Vermeer Foundation*.
8. Yamane, T. "Research Methods: Determination of Sample Size." (2007).

JOURNALS

1. Aryee, B.N., 2001. Ghana's mining sector: its contribution to the national economy. *Resources Policy*, 27(2), pp.61-75.
2. Bakolas, E. and Cowlagi, R.V., 2010. Highlights from the literature on accident causation and system safety: Review of major ideas, recent contributions, and challenges. *Reliability Engineering & System Safety*, 95(11), pp.1105-1116.
3. Biyase, L., 2011. Mapungubwe under threat: sensitive historic site may lose World Heritage status due to nearby mining activity. *Sunday Times–Business Times*.
4. Camara, O., Hanif, I., Tunes, M., Harrison, R., Greaves, G., Donnelly, S. and Hinks, J., 2017. Effects of temperature on the ion-induced bending of germanium and silicon nanowires. *Materials Research Express*, 4(7), p.075056.
5. Campbell, J., 2002. The new metallurgy of cast metals. *Materials Solutions* 2002.

6. Cooke, D.L. and Rohleder, T.R., 2006. Learning from incidents: from normal accidents to high reliability. *System Dynamics Review*, 22(3), pp.213-239.
7. Corbett, D.R., Dillon, K., Burnett, W. and Schaefer, G., 2002. The spatial variability of nitrogen and phosphorus concentration in a sand aquifer influenced by onsite sewage treatment and disposal systems: a case study on St. George Island, Florida. *Environmental Pollution*, 117(2), pp.337-345.
8. Donoghue, A.M., 2004. Occupational health hazards in mining: an overview. *Occupational medicine*, 54(5), pp.283-289.
9. Drake, P. L., Rojas, M., Reh, C.M., Mueller, C.A., Jenkins, F.M. (2001). "Occupational exposure to airborne mercury during gold mining operations near El Callao, Venezuela." *International Archive of Occupational and Environmental Health* 74(3): 206-12.
10. Driscoll, D.J., Fisher, C.A. and Slater, P.R., 2005. Atomic-scale investigation of defects, dopants, and lithium transport in the LiFePO₄ olivine-type battery material. *Chemistry of Materials*, 17(20), pp.5085-5092.
11. Elliot, B. and Ackland, T., 1981. Biomechanical effects of fatigue on 10,000 meter running technique. *Research quarterly for exercise and sport*, 52(2), pp.160-166.
12. Eweje, G., 2005. Hazardous employment and regulatory regimes in the South African mining industry: Arguments for corporate ethics at workplace. *Journal of business ethics*, 56(2), pp.163-183.
13. Furter, J.E. and Sitta, A.M., 2009. Nondegenerate Umbilics, the Path Formulation and Gradient Bifurcation Problems. *International Journal of Bifurcation and Chaos*, 19(09), pp.2965-2977.
14. Groves, W.A., Kecojevic, V.J. and Komljenovic, D., 2007. Analysis of fatalities and injuries involving mining equipment. *Journal of safety research*, 38(4), pp.461-470.
15. Kecojevic, V.L.A.D.I.S.L.A.V., Md-Nor, Z.A., Komljenovic, D.R.A.G.A.N., Groves, W.I.L.L.I.A.M. and Grayson, R.L., 2008. Risk Assessment for continuous miner-related fatal incidents in the US underground mining. *Mineral Resources Engineering*, 13(2), pp.49-60.
16. Kohler, M. and Stradling, J.R., 2010. Mechanisms of vascular damage in obstructive sleep apnea. *Nature Reviews Cardiology*, 7(12), p.677.
17. Labonne, B., Katsiaouni, O. and Carnegie, J., 2000. Poverty Eradication and Sustainable Livelihoods: Focusing on Artisanal Mining Communities. *United Nations Department of Economic and Social Affairs (UNDESA), Project RAF/99/023, New York.*

18. Melchers, R.E. and Kal, W.M., 2000. An analysis of safety control effectiveness. *Reliability Engineering & System Safety*, 68(3), pp.187-194.
19. MINIRENA, 2009. Perks, R., 2013. Digging into the past: critical reflections on Rwanda's pursuit for a domestic mineral economy. *Journal of Eastern African Studies*, 7(4), pp.732-750.
20. Mung'ala-Odera, V., Meehan, R., Njuguna, P., Mturi, N., Alcock, K.J. and Newton, C.R.J.C., 2006. Prevalence and risk factors of neurological disability and impairment in children living in rural Kenya. *International journal of epidemiology*, 35(3), pp.683-688.
21. Ndlovu, S., 2008. Biohydrometallurgy for sustainable development in the African minerals industry. *Hydrometallurgy*, 91(1-4), pp.20-27.
22. Oakes, M., Baxter, L. and Long, T.C., 2014. Evaluating the application of multipollutant exposure metrics in air pollution health studies. *Environment international*, 69, pp.90-99.
23. Osanloo, Rahmanpour, M., M., Adibee, N. and AkbarpourShirazi, M., 2014. An approach to locate an in pit crusher in open pit mines. *International Journal of Engineering-Transactions C: Aspects*, 27(9), p.1475.
24. Qafoku, N.P. and Icenhower, J.P., 2008. Interactions of aqueous U (VI) with soil minerals in slightly alkaline natural systems. *Reviews in Environmental Science and Bio/Technology*, 7(4), pp.355-380.
25. Sagan, C., Thompson, W.R., Carlson, R., Gurnett, D. and Hord, C., 1993. A search for life on Earth from the Galileo spacecraft. *Nature*, 365(6448), pp.715-721.
26. Sekerin, V., Dudin, M., Gorokhova, A., Bank, S. and Bank, O., 2019. Mineral resources and national economic security: current features. *Mining of mineral deposits*, (13, Iss. 1), pp.72-79.
27. Shields, D.J. and Šolar, S.V., 2005. Sustainable development and minerals: measuring mining's contribution to society. *Geological Society, London, Special Publications*, 250(1), pp.195-211.
28. Stephens, C. and Ahern, M., 2001. Worker and community health impacts related to mining operations internationally: a rapid review of the literature. *London: London School of Hygiene & Tropical Medicine*.
29. Suekuni, K. and Takabatake, T., 2016. Research Update: Cu–S based synthetic minerals as efficient thermoelectric materials at medium temperatures. *Apl Materials*, 4(10), p.104503.

30. Taureck, R., 2006. Securitization theory and securitization studies. *Journal of International relations and Development*, 9(1), pp.53-61.
31. Turyaguma, A. & Matsiko, G. (2001). "Ntare school on strike, battles anti-riot police", In the New Vision, Thursday, October 14, 2001, Vol. 16 No. 238, The New Vision Printing and Publishing Corporation, Kampala.
32. Veiga, M.M. and Beinhoff, C., 1997. UNECA centers: A solution to reduce mercury pollution from artisanal gold mining activities. *UNEP Industry and Environment*, 20(1), pp.49-52.
33. Zohar, D., 2002. The effects of leadership dimensions, safety climate, and assigned priorities on minor injuries in work groups. *Journal of organizational behavior*, 23(1), pp.75-92.

OTHER PUBLICATIONS

1. Akabzaa, T. and Darimani, A., 2001. Impact of mining sector investment in Ghana: A study of the Tarkwa mining region. *Third World Network*.
2. Aryee, B. (Minerals Commission, Ghana) (2003), "Retrospective on the Ghana Experience: Overview of Artisanal Mining and its Regulation in Ghana." Presentation at the 3rd Annual General Meeting of the World Bank Communities and Small-Scale Mining Program, Elmina, Ghana, September 8, 2003.
3. Awudi, G.B., 2002. The role of foreign direct investment (FDI) in the mining sector and the environment. In *Proceedings of the Conference on Foreign Direct Investment and the Environment Lessons to be Learned from the Mining Sector, Paris, France*.
4. Charles G. Oakes (2011) Blue Ember Technologies, LLC. "Safety versus Security in Fire Protection Planning Archived 2012-03-13 at the Wayback Machine," The American Institute of Architects: Knowledge Communities, May 2009. Retrieved on June 22, 2011.
5. Heath, M.J., Merefield, J. R., Paithankar, A.G. (2013), "Environmental impact of mining in tropical forest", *Mining Environmental Management*, September 1993.
6. Hebblewhite, M., Anders, A.D., Maier, J.A. and Wilmers, C.C., 2009. Global population dynamics and hot spots of response to climate change. *BioScience*, 59(6), pp.489-497.
7. Keynes, J.M., Obshchaya teoriya zanyatosti, protsenta i deneg [General Theory of Employment, Interest Rate and Money]. Moscow, EKSMO, 2007.

8. Mitchell, D.W. and Burns, F.A., 1979. *Interpreting the state of a mine fire* (Vol. 1103). Department of Labor, Mine Safety and Health Administration.
9. Mokoena, M.C., 2016. *A constructive analysis of safety control mechanisms and production costs at a coal mine* (Doctoral dissertation).
10. Pandya, K. (2010). Environmental Protection Agency (EPA), <http://www.epa.gov.gh/mining/index.html>
11. RNRA, 2013). Magis, M., 2013. Inception Report: Land Administration and Registration Adviser and Workplan.
12. Son, J.H., LG Semicon Co Ltd, 2000. *SOI (silicon on insulator) device and method for fabricating the same*. U.S. Patent 6,110,769.
13. Stellman, J.M., McCann, M., Warshaw, L., Brabant, C., Finklea, J. and Messite, J., 1998. *Encyclopaedia of occupational health and safety*: International Labor Office. Geneva, Switzerland.
14. UNDP (2003) UNDP, B., 2003. Human Development Report–2003–Millennium development Goals in B&H.

THESES

1. Aawaar, G. (2006), *The Economic Impact of Mining Sector Investment in Ghana*, Undergraduate Dissertation, Faculty of Social Sciences, Kwame Nkrumah University of Science and Technology.
2. Acheampong, E. (2004), *Impact Assessment of Mining Activities by Ashanti GoldfieldsBibiani Limited on the Environment and Socio-Economic Development of Bibiani*, Undergraduate Dissertation, Faculty of Social Sciences, Kwame Nkrumah University of Science and Technology.
3. Baleni, P. (2011). *Physio-Chemical Evaluation of Some Mining Impacted Water Bodies within the Obuasi Environment*, Department of Geology, University of Ghana, Legon.

ONLINE SOURCES

1. AMLA. 2017 African Mining Legislation Atlas (AMLA) Project. Available at <http://www.globalforumljd.org/cops> African Mining Legislation Atlas (Accessed 15 March 2017).

2. Brody et al, (1990). Mining accidents on the rise; who should be held responsible. <https://www.newtimes.co.rw/news/mining-accidents-rise-who-should-be-heldresponsible>, published on 18th June 2018 and retrieved on 10th December 2019
3. Mining Inspection Report, 2017 Panel, A.P., 2013 "Equity in Extractives: Stewarding Africa's Natural Resources for All" Africa Progress Report (2013). Genève: Africa Progress Panel. Retrieved from <http://www.africaprogresspanel.org> (Access February 16, 2020).

APPENDICES

APPENDIX ONE:

QUESTIONNAIRE TO MINEWORKERS

EFFECT OF MINING SAFETY RISKS ON HUMAN SECURITY IN RWANDA – A CASE OF MINING INDUSTRY IN MUHANGA DISTRICT

The information provided to this study will be kept with a lot of confidentiality and secrecy

Section A: Biodata of respondents

1. Gender of respondent:
 - (1) Male []
 - (2) Female []
2. Social status of respondents
 - (1) Single []
 - (2) Married []
 - (3) Divorced []
3. Educational background
 - (1) No-formal []
 - (2) Primary []
 - (3) Secondary []
 - (4) University []
4. Working experience in mining sector
 - (1) below 5 years
 - (2) 5 – 10 years
 - (3) Above 10 years

SECTION B: The effect of mining safety risks on health security of mine workers in Muhanga District of Rwanda

5. Have you experience any mining safety related risk in your mining career?
 - (1) Yes
 - (2) No
6. If yes, which one in the following
 - (1) Mining fatality
 - (2) Severe injury
 - (3) Loss of body part (s)
 - (4) Minor injuries
 - (5) Respiratory diseases
 - (6) Lung diseases
7. If no, do you think your company / cooperative have done enough to protecting you against mining safety risks?
 - (1) Yes
 - (2) No
8. If yes, do you have the following tools and equipment
 - (1) PPE
 - (2) Walk talkies
 - (3) Helmets
 - (4) BA in case of emergency
 - (5) First aid Tool kit
 - (6) Health and safety signs at mine site
9. if yes, do you always wear PPE while working?
 - (1) yes []
 - (2) no []
10. How many have you seen losing the lives in this mine work?
 - (1) None
 - (2) Below 5 people
 - (3) 5-10 people
 - (4) Above 10 people
11. How many got injuries in mining work?
 - (1) None

- (2) Below 5 people
- (3) 5-10 people
- (4) Above 10 people

12. How many got mining related diseases?

- (1) None
- (2) Below 5 people
- (3) 5-10 people
- (4) Above 10 people

13. Do you have any sort of alert in case of emergency to your co-worker under the mining site?

- (1) Yes [☐]
- (2) No [☐]

14. My company/coop provides adequate equipment, materials and personal protective equipment (PPEs) to enable employees to carry out their work safely.

- (1) Agree [☐]
- (2) Disagree [☐]
- (3) Neutral [☐]

15. Safety materials provided by my company / cooperative are used all the time at the workplace

- (1) Agree [☐]
- (2) Disagree [☐]
- (3) Neutral [☐]

16. My company provides notices on all health and safety measures

- 1) Agree [☐]
- 2) Disagree [☐]
- 3) Neutral [☐]

17. Safety induction, orientation and refresher courses are conducted by my organization at the workplace.

- (1) Agree [☐]

(2) Disagree []

(3) Neutral []

18. Co-workers in my organization ensure the safety of fellow workers to avoid unreasonable health related risk.

(1) Agree []

(2) Disagree []

(3) Neutral []

SECTION C: The relationship between mining safety risks and economic security of mine workers in Muhanga District of Rwanda

19. What do you think are the main causes of the persisting mining safety risks? among the following:

(1) Lack of PPE []

(2) Lack of safety signs at site []

(3) Ignorance []

(4) Carelessness []

(5) Poor Supervision []

(6) Others [] Specify

20. What are some of the measures being undertaken at your mine site to ensure safety and economic security of mine workers?

(1) Provision of PPE to each miner []

(2) Closing and filling abandoned site []

(3) Doing professional training []

(4) Hiring experts []

(5) Proper signage and following the latest safety rules []

(6) Others [] Specify

21. Management responds quickly to safety concern.

(1) Agree []

(2) Disagree []

(3) Neutral []

22. Do you think there is a relationship between mining safety risks with economic security?

(1) Agree []

(2) Disagree []

(3) Neutral []

SECTION D: The recommendations to ensure mining safety of mine workers to enhance human security in Muhanga District of Rwanda

23. Do you think the mining inspectors do inspect the following areas to ensure mining safety and human security? (1- Strongly Agree, 2- Agree, 3- Neutral, 4- Disagree, 5- Strongly Disagree)

Area of inspection	1	2	3	4	5
Training of mineworkers					
Professionalism of mineworkers					
Mining health and safety signage at mine site					
Safety of mine site					
Mining seasons and climate change					
Environmental degradation					
Health of mine workers					
Health insurance of mine workers					
Supervision of mining team					
Safety procedure documentation					
Latest standards of health and safety in mining sectors					
Number of closed abandoned mine sites					

24. Basing on your level of agreement in question 23 indicate your level of recommendation that you can provide to ensure mining safety and human security of mine workers (1- Strongly Agree, 2- Agree, 3- Neutral, 4- Disagree, 5- Strongly Disagree)

Recommendation	1	2	3	4	5
No mineworker should be subjected to unreasonable mining safety risk					
Mining companies and government should give professional training					
Mining health and safety signage should be placed at mine sites					
Mine sites should record both small and big mining incidents					
Conducting periodic review of mining safety					
Protecting environment and closing abandoned sites					
Provision of emergency equipment and means of alert					
Provision of life insurance					
Use of technology in mining					
Provision of safety notices in all mine sites					
Adoption of latest standards of mining safety					
Provision of PPE to all miners					

25. Any other recommendation, please! State,

Thank you for your kind participation

APPENDIX TWO:

INTERVIEW GUIDE TO LOCAL LEADERS AND COMPANY OWNERS

SECTION A: The effect of mining safety risks on health security of mine workers in Muhanga District of Rwanda

1. What are the main mining safety risks you experience here?
2. do miners always wear PPE while working?
 - (3) yes []
 - (4) no []
3. if yes, What are the mining tools and equipment you have here?
4. How many have you seen losing the lives in this mine work?
5. How many got injuries in mining work?
6. Have many got mining related diseases?
7. Do you have any sort of alert in case of emergency to your co-worker under the mining site?
 - (3) Yes []
 - (4) No []
8. Do you conduct Safety induction, orientation and refresher courses are conducted by my organization at the workplace?
 - (4) Agree []
 - (5) Disagree []
 - (6) Neutral []
 - (4) Neutral []

SECTION B: The relationship between mining safety risks and economic security of mine workers in Muhanga District of Rwanda

9. What do you think are the main causes of the persisting mining safety risks?
10. What are some of the measures being undertaken at your mine site to ensure safety and economic security of mine workers?
11. Do you think there is a relationship between mining safety risks with economic security?

(4) Agree []

(5) Disagree []

(6) Neutral []

SECTION D: The recommendations to ensure mining safety of mine workers to enhance human security in Muhanga District of Rwanda

12. Do you think the mining inspectors do inspect the following areas to ensure mining safety and human security? (1- Strongly Agree, 2- Agree, 3- Neutral, 4- Disagree, 5- Strongly Disagree)

Area of inspection	1	2	3	4	5
Training of mineworkers					
Professionalism of mineworkers					
Mining health and safety signage at mine site					
Safety of mine site					
Mining seasons and climate change					
Environmental degradation					
Health of mine workers					
Health insurance of mine workers					

Supervision of mining team					
Safety procedure documentation					
Latest standards of health and safety in mining sectors					
Number of closed abandoned mine sites					

13. Basing on your level of agreement in question 23 what can you recommend to ensure mining safety and human security of mine workers?

Thank you for your kind participation