EFFECTS OF MINING ON SOCIETY, LIVELIHOODS AND ENVIRONMENT, IN TAITA TAVETA COUNTY, KENYA

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DECLARATION

This thesis is my original work and has not been presented for an award of a degree in any other university.

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Supervisor Declaration

This thesis has been submitted for examination with our approval as university supervisors.
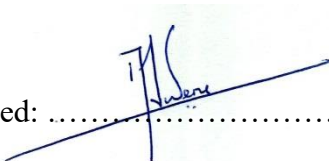
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DEDICATION

First I dedicate this research work to my Lord and Savior Jesus Christ who has sustained me through the turbulence I have endured while working on this project. It has been Great Grace.

I also dedicate this research to my precious family (Agnes M. Tuja my 86 years old mother, my spouse, Mr Fred K. Mwakesi and my sons Mwakesi and Tuja, my grandchildren and my siblings) who prayed and cheered me on and remained my source of encouragement, to never give up soldiering on, when the environment around me became extremely difficult, harsh and unbearable.

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LIST OF ACRONYMS AND ABBREVIATIONS

ASM   Artisanal and Small-Scale mining

CBOs   Community Based Organizations

CFAs   Community Forest Associations

CSO   Civil Society Organization

EAP   Environmental Action Plan

EIA   Environmental Impact Assessment

EMCA   Environmental Management and coordination Act

FGD   Focus Group Discussions

GDP   Gross Domestic Product

GFA   Global Forests Atlas

ICMM   International Council on Mining and Metals

IFAD   International Fund for Agriculture Development

KFS   Kenya Forest Service

KNBS   Kenya National Bureau of Statistics

KM   Kilometers

KWS   Kenya Wildlife Service

NEMA   National Environmental Management Authority

NGOs   Non-Governmental Organizations

NO_2 Nitrogen dioxide

PM   Particulate matter

REDD+   Reducing Emissions from deforestation and forest degradation

SO_2 Sulfur dioxide

SPSS   Statistical Package for Social Sciences

SSM   Small Scale Mining

TTC	Taita Taveta County
UNCED	United Nations Conference on Environment and Development
UNEP	United Nations Environment Programme
WB	World Bank
WCED	World Economic Commission and Development
WWF	Worldwide Fund for Nature

ABSTRACT

Mining has been blamed globally for harmful and impoverishing effects. Most countries are rich sources of the gemstone, yet there is very little development, since miners, and those around mining sites, still live in poverty. This premise formed the purpose of this study and led the researcher to assess the impacts of mining on people living around mining areas on the aspects of their socio-cultural dynamics, livelihood and environmental conditions. This study was done at Mwatate sub-county in Taita Taveta County. Specific mining areas were Kamtonga and Mkuki. Questionnaires, observational record sheets and guided discussions were used as inquiry tools to collect information on the problem under study. Livelihood Framework analysis was adopted to show the interplay between mining and development. The research method applied included structured questionnaires administered using mobile technology to target random respondents of 173 out of 990 households drawn from nine villages. Observation method was applied in the case of environmental impacts. Record sheets were used to collect data in nine purposive selected mining sites on the elements of vegetation, topography and air. The descriptive and content analytical approach was applied to assess the mining impact on the environment. Key Informants interviewed were also purposively selected, for a one-on-one discussion based on their exposure to the mining operations. Data was collected examined and analysed for accuracy by arranging it into manageable units and identifying patterns among variables. The findings were presented on tables for clear understanding. The findings on socio-cultural aspects, respondents agreed on a scale of 1-4 (1=strongly disagree, 2=Disagree, 3=Agree and 4=Strongly agree), that there were loss of their ancestral land, conflicts, dilution of Taita culture through mixed intermarriages, increased prostitution, alcoholism and high school dropouts. On the aspect of livelihoods, open mining pits and large-scale mining have caused the loss of agricultural land even though it has enhanced the ability to meet day to day needs for the communities and

improved their livelihood. Because of mining activities, diverse economic activities have also grown in Taita Taveta. The study revealed that Taita Taveta County recorded a higher monthly income of Ksh. 46,468 from mining, followed by Machakos County Ksh.18,500 compared to Makueni, Kilifi, Kitui and Tana River counties The study also revealed varied mining effects concerning the migration of communities from other counties into mining areas of Taita. Observation done on the environment at the mining areas revealed that trees, shrubs and grassland were cleared for mining activities. Forests and most of the natural habitation and indigenous trees have been eliminated. Additionally, the lives of both domestic and wild animals have been interrupted. Underground mining has interfered with water beds and rivers have dried up. In a scale of 1-5 (1=None, 2=Very thin, 3=Thin, 4=Thick, 5=Very thick) it was observed that transportation of materials created thick dust on the environment as given in a scale of 4. The uncontrolled dust is very common and miners require more visibility of NEMA and Kenya Forest Service (KFS). There is a need for an active legal framework to regulate the mining operations in Taita-Taveta County. Other suggestions would be to increase economic activities which will enhance livelihood improvement if efforts to understand the characteristics of the diversified communities are employed. Improving the livelihood of these communities may require the involvement of policymakers, Environmental Impact Assessment reports before, during and after the mining operations is desired.

Keywords: Environment, Household, Land, Livelihood, Mining, Poverty, Sustainability

CHAPTER ONE: INTRODUCTION

1.1 Background Information

The extractive industry is as old an exercise as human development itself. As populations grow, there are greater demand for urbanization, social and economic development benefits, calling for an increase of more minerals and metals which to a great extent also affect the environment negatively as recorded in the International Council on Mining and Metals report. (ICMM, 2014).

Mining is a major economic activity in many developing countries, however, unregistered and illegal small scale miners exist everywhere (Hilson, & McQuilken,2014). Mining operations, whether small or large-scale, are inherently disruptive to the environment, producing enormous quantities of waste that can have deleterious impacts for decades. The environmental deterioration caused by mining occurs mainly as a result of inappropriate and wasteful working practices and rehabilitation measures. Mining has several common stages or activities, each of which has potentially adverse impacts on the natural environment, society and cultural heritage, the health and safety of mineworkers, and communities based close to operations. Several authors have commented on the potentially adverse impacts of mining, including the displacement of local people from ancestral lands, marginalization, and oppression of people belonging to lower economic classes (Kitula, 2006).

According to (Boadi, S.*et al*.2016). mining is associated with the destruction of forest reserves, denying thousands of people an avenue for their livelihood. An example is Ghana whose forest reserve at independence in 1957 was 8.3 million hectares and was depleted to 1.2 million by 2003 as a result of allowing gold mining activities in the forests (CCPA Monitor 2003). Displacement of indigenous people from their ancestral and communal lands has brought a lot

of strains on livelihood (Darimani et al., 2013). Unemployment rates have escalated in the rural communities who live within the mines catchment areas, resulting in poverty and unsustainable livelihood. The Sustainable Livelihood idea was first introduced by the Brundtland Commission on Environment and Development, and the 1992 United Nations Conference on Environment and Development (UNCED) expanded the concept, advocating for the achievement of Sustainable Livelihood as a broad goal for poverty eradication.

In Africa, natural resource exploitation and extraction activities have had adverse results for communities living around the project affected areas. Various actors including government entities and private companies have violated and abused human rights, the environment and social and economic development (Adeola, 2001). Such practices have resulted in long-term and sometimes irreversible negative impacts on people living in and around mining areas. Communities have been displaced in addition to harmful practices such as dumping of untreated chemical waste. These primary violations, in turn, led to secondary harms with long-lasting consequences, such as the inability to realize other human rights, especially economic, social and cultural rights which include loss of housing, destruction of livelihoods, loss of economic opportunities, lack of access to education for the children and young people, and repercussions on health resulting from environmental pollution (Olawuyi, 2018)

Kenya has had rapid growth in the mining industry during the last two decades. A variety of minerals are found in Kenya. Artisanal and Small-Scale Mining (ASM) has been significant. ASM plays a pivotal role in job creation, it is an activity accompanied by several social and environmental consequences and abject poverty is still witnessed among the miners in ASM. Most of the rural people engage in ASM even while they are aware of destroying the river

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systems through poor mining practices (Davies & Osono, 2005). Kenya is no exception concerning the negative effects caused by mining or extractive industry.

1.2 Statement of the Research Problem

Several factors led to the rationale of this study. Extractive industry activities have left some of the communities, living around mining areas, with unsustainable livelihood conditions socially, economically and environmentally. Brundtland Commission definition of sustainable development is "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987). Similarly (Chambers & Conway, 1992) looked at sustainability broadly as a livelihood that has a means of living of both present and future. Therefore it should sustainably cope even with the surrounding destructions.

Sustainable development is a wholesome combination of livelihood which includes enhanced socio-economic growth and development, environmental protection and pollution prevention. (Hilson &Murck, 2000). Although Taita Taveta County (TTC) is endowed with some of the richest minerals deposits in Kenya and the Eastern Africa region (Mohamed, *et al.* 2019), harvesting attracts mainly people from outside the county (Rop, 2014; Environment Action Plan 2009-13). Mineral has the potential of generating considerable wealth which would impact peoples' livelihoods positively, however, poverty in the county continues to spread unabated (Mghanga, 2011). This is also because there has been no clear government regulations and control (Taita-Taveta Professionals Forum, 2008).

1.3 Objectives of the study

1.3.1 General Objective

This study investigated and scrutinised the impacts of the extensive mining activities on communities' livelihoods to find ways of improving their living standards.

1.3.2 Specific Objectives

    i.   Scrutinize the Socio-cultural impacts of mining among the communities in Taita-Taveta

    ii.   To assess the impacts of mining on household livelihoods in Taita-Taveta

    iii.   To observe the environmental impact of mining on topography, air and vegetation

1.3.3 Research Questions

This research answered three questions concerning the mining industry in Kenya since its inception to the present.

    i.   What is the social status of communities living around mining areas?

    ii.   How have mining activities impacted household livelihoods?

    iii.   What is the state of the environment in mining areas?

1.4 Theoretical framework

Two theories guided this study. The first theory is the tragedy of the commons under the sustainable livelihood framework. Exploitation is the use of someone or something unjustly or cruelly, or generally as a means to ones' end or profit. Mining activities have brought conflicts because of the selfish nature displayed by prospectors and miners and Hardins, 1968 described the 'tragedy of the commons' as an expression of individuals taking care of their independent self-interests and depleting common resources while neglecting other peoples' long-term

interests (Ostrom, 2008). Another theory, conflict theory, originates from the works of Karl Marx (Omer & Jabeen, 2016). This theory is premised on the social discrepancy created between the miners and the surrounding communities like in the mining fields of Taita Taveta County. How the powerful minorities oppress the majority of inhabitants. The theory states that tension and conflicts arise when resources, status and power unevenly distributed between groups in society, become the engine for social change.

1.5 Justification

Taita Taveta County (TTC) has become a popular county because of its gemstone minerals (Central Bank, 2008; Hentschel, 2003). Minimal publishing has been done on the political, economic, social and environmental impacts of mining in the country including prospects of mining and conflicts over land and mineral resources (Mghanga, 2011). This means that there is no documentation published concerning the impacts of mining on people's livelihoods, except for those addressing the natural science and geological issues driven by prospector, investor and trade interests. This knowledge, therefore, formed the basis and justification of this study whose aim is to scrutinise the impacts of mining on the people who live close to the mining areas

1.6 Scope

This study examined the impacts of mining on sustainable livelihoods of the communities dwelling in extractive industry areas in this case mining areas. Initial scoping was performed to develop an understanding of local livelihoods patterns and other relevant issues including the type of extractive industry in the area. Taita Taveta County in Kenya was the case study in a particular sub-county known as Mwatate, where mining fields such as Kamtonga, Kapanga, and Mkuki are found. These areas are rich in gemstones such as Green Garnet, Ruby, Red

Garnet, Blue Sapphire, Yellow garnet, Rhodolite, Chawia, Iron-ore, Kyanite, Asbestos, Chrome, Potassium Feldspar, Hornblende, Diopside, Apatite, Vanadium grossularite, Magnetite, Marble, and Quartz feldspar. To obtain concrete results cooperation from miners, stakeholders, key informants and the communities or households was crucial

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1.7 Limitations

This study was dependent on available information and survey results. Looking at the period since independence presented blank areas in terms of memory lapses or archived material.

CHAPTER TWO: LITERATURE REVIEW

2.1 General Review

Literature review on this paper looked at both the positive and negative impacts of mining activities to the well-being of the communities living or residing near the mining areas as indicated on the problem statement. The review helped to identify the gaps and explain socio-cultural and environmental impacts levels, which would hopefully allow ways of changing and improving the existing scenario in Taita Taveta County, the case study area of the research paper.

Minerals are defined as naturally occurring solid chemical substances that are formed through geological processes and that have a characteristic chemical composition, highly ordered atomic structure, and specific physical properties (Velde, 1995). By comparison, rocks are an aggregate of minerals and or mineraloids that do not have a specific chemical composition. Minerals range in composition from pure elements and simple salts to very complex silicates with thousands of known forms.

2.2 Socio-cultural impacts

Mining is a major economic activity in most developing countries particularly in rural sub-Saharan Africa (Kitula, 2006). At the extreme, mining has led to growing conflicts among most communities displaced by mining operations and has even increased the presence of social vices such as prostitution, substance abuse, gambling, and incest, and general destabilisation of families and livelihood (Darimani et al., 2013; Gualnam, 2008).

Potential conflicts between mining and other land use prompted some communities to pass non-binding referendums, banning mineral activities. An example of this is when in June 2002

the Peruvian community of Tambo Grande rejected mining activities in their community because of displacement of half of its residents. They also had fears regarding the potential influences mining would impact on the community's traditional livelihood (Oxfam, 2004). Displacement creates serious social problems which include marginalization, food insecurity, and loss of access to common resources and public services, and social breakdown as reported in the Mining Minerals and Sustainable Development (MMSD) report of, 2002 (Starke, 2002).

 In India, Bharali (2006) informs that, displacement of people from traditional habitats causes much trauma to the affected persons. Compulsory acquisition of land for construction of dams and roads, quarrying and mining operations, industries and reservation of forests for National Parks and environment protection, forces people to leave their traditional abodes and land, which is their main sustenance. Thus, development projects have often become a major threat to the people who are deprived of their traditional livelihood without alternatives. Nearly 50-60 million people have been displaced by development projects in India as a whole and this constitutes at least 40% of them (Bharali, 2006). Cash payment does not compensate for the difficulties people experience in their lifestyle and ethos. Mining degrades and decreases agricultural land by shortening the fallow period (Akabzaa & Darimani, 2001). In Ghana, some traditional livelihood aspects taken over by mining include rice fields, vegetable gardens, hunting and grazing livestock. Additionally, traditional small scale miners also lost the small areas allotted for mining of gold to the bigger mining firms. Communities have lost their cultural and traditional undertakings like landscapes, mountainsides, burials and hunting sites because of mining and deep open pits (Appiah & Buaben, 2012; Bush, 2009) declares that mining, has forced people, especially women to find alternative forms of livelihood on their own.

2.3 Livelihoods Impacts

Mining can alleviate the poverty of communities who reside around the mining areas The scenario regarding socio-cultural impacts differs depending on the economic setups of countries or regions. Mining activities can impact negatively or positively due to the technical development of each country and also due to the legislative systems governments may have put in place. The International Council on Mining and Metals ICMM (2014) report, documents that the mining sector has implications on the economic impact which is not always positive. All the countries are less developed except in the lowest world's countries where mining is most important (Buckley, 2019). A handful of countries such as Australia and Canada may have done well while some are emerging economies.

The role of mining in the Australian economy and society has been propelled by the mining boom in that country (Weller & O'Neill, 2014). Canada, human capital is 'outsourced'. This implies that local people are not engaged in the activities of the mining industry. Great reliance on non-resident workforces weakens sustainable community development and economic diversification (Perry & Rowe, 2015). Engaging non-resident workers in mining activities foster tensions between them and residents who have lived for long with their community and borne the economic sustainability burden of the towns involved.

Effects of social costs of mining boom result in crime and violence because of little work to do (Sincovich, et al., 2018). Discontent fuels conflicts. A case in hand is in Peru where the reality of the so-called 'resource curse' or paradox of plenty is very visible. Ways of mitigating the impacts of this curse are being sought out because countries that possess significant natural resources often suffer when resources are extracted and exported. Similarly in Taita resources are extracted and exported by the miners leaving the county residents in poverty.

Commenting on the minerals in East Africa, Velde (1995) explains, "Of approximately three hundred thousand mineral species that are found today, only 90 have beauty, rarity and durability that qualify them like gemstones. Of these species, twenty are known to the jeweller. East Africa has more than its share of the unusual gemstones. According to the Central Bank (2008), the bulk of Kenya's gemstones are presently produced from one district known as Taita, (which is now Taita Taveta county). The gemstone belt stretches between Kenya and Tanzania.

Information about mining in Taita Taveta county generated a lot of attention about it as a location of minerals, particularly gemstones (Central Bank, 2008), even though the economic impact, of the vast existing natural resources extraction, on local people and its effects on the environment has not been researched. The study area focused on a selected area of Taita Taveta County with extensive mining activities to examine how natural resources extraction activities could contribute to sustainable livelihoods among the local communities. Areas touching on the relationship between mining and gender, human rights, education, health, environment, water, social and economic standing are the variables included in the study. Natural resources can provide poor counties with large revenue streams that can be used to alleviate poverty, which can enhance the much-needed peace and co-existence with other communities in the counties who up to now are regarded as exploiters of community resources (Pegg, 2006).

With such a rich resource of wealth, one would expect that the county GDP would be soaring high and poverty would be history. This is not so in Kenya, specifically the study area in Taita Taveta county whose inhabitants remain poor with no land and many living as squatters and only a few owning both the land and control of its wealth (Waiganjo, 2019). Those with land

have leased it out to mine extractors who pay them minimally after a very long time when eventually minerals are extracted and traded. Natural resources extraction has adversely affected the living standards of the local Taita Taveta people more negatively than positively hence qualifying the tragedy of the commons trajectory. Vast land usage through this practice has also impacted the environmental standards of the county living most parts of the lowlands of Taita bare and dry. This has resulted in environmental degradation, famine and poverty.

Mining activities in Taita Taveta are concentrated in the plains that include Tsavo East and West national parks. Both gemstones and industrial minerals are mined in the area (Zollo, 2019). Because of the abundance of minerals many people in Taita Taveta have considerable general knowledge about names and types of minerals, mining and geology of the area which helps them to assist geologists operating in the areas (Waiganjo, 2019). In Mwatate mining sites and industrial minerals are scattered in various parts known as Kamtonga, Mgeno, Chawia, and Chungauga. These areas are rich in gemstones such as green garnet ruby red garnet, blue sapphire, yellow garnet, rhodolite, chawia, iron-ore, kyanite, asbestos, chrome, potassium feldspar, hornblende, diopside, apatite, vanadium grossularite, magnetite, marble, and quartz-feldspar (Horkel *et al*., 1984). Given the above background, it is therefore imperative to conduct this study, to examine the gaps involving the impacts of the mining on communities' social-cultural, livelihoods and environmental aspects. This study will explore why local people not only in Taita but globally continue to be exploited out of the mineral resources within their ancestral land, and what mitigation steps should be developed to promote sustainable development.

2.4 Environmental Impacts

Minerals are the natural resources which play an important role in the economic development of the country. But the extraction and mining of these natural resources lead to some adverse effect on the environment. Mining affects vegetation, farmlands, livestock and aquatic activities through pollution leading to negative effects in agriculture and food security (Hayes, 2008). Mining tends to drive people away from sustainable livelihoods, for instance, farming to other livelihoods which may result in possible destruction of productive land resources. Such alternative changes lead to further destruction of the environment and expose peoples' livelihoods to unsustainable risk (Hilson and Banchirigah, 2009; Adjei, 2007).

Mining activities produce a lot of dust which result in polluted air and also contaminated surfaces and groundwater through the infiltration of leached drainage (Naja & Volesky, 2009). Naja & Volesky (2009) also stated that mining made the soil infertile through degradation hence adversely affecting natural vegetation. Other major consequences include the loss of Flora and fauna, affected and destabilized ecosystem due to infected water, soil and loss of habitat. Mined land remains unsuitable for industrial and agricultural purposes (Pandey, 2020).

Mining operations have devastating effects on nearby streams, rivers and surrounding vegetation (Apollo *et al*., 2017). Consumption of contaminated toxic water and soil or plants cause diseases in people and animals and can result in death. Huge volumes of dust are caused by explosions, transportation and processing. Collecting runoff water using ponds would help but the problem would persist (Gupta & Gupta, 1998). Other environmental impacts of mining activities recorded in the literature include permanent scarring of land surfaces where wastes are dumped. Deep mines holes may subside vertically or horizontally and cause damage to

buildings, roads, farmland and surface drainage patterns. More disturbances to residents and wild-life are caused by noise from blasting and transport at the mining areas (Bell *et al*., 2000).

2.5 Research Gaps

Studies have been conducted in some of the African countries on poverty, health education and food security. Equally, several studies have been undertaken on the county to document the available resources, the mining companies, and the socio-economic attributes of the Taita – Taveta people (Zollo, 2019; Mohamed et al., 2019; Mwakumanya et al., 2016; Anyonna & Rop, 2015; Rop, 2014). However, there is scanty information on the impact of mining on the communities who dwell around the mining areas and their socio-economic, livelihoods and environmental aspects. Other researched areas concentrated on the political economy of the mining area associated with conflicts over land and mineral resources (Mghanga 2011). Research on the impacts of mining on immediate communities has remained elusive for a long time, (Taita Taveta Integrated Development Plan 2013). Another research focused on the local implementation of the Environmental Management Coordination Act (EMCA) of 1999 (Amendment) Regulations, 2016) in Taita Taveta County (Funder & Marani, 2013). Article 43 and 69 of the Kenya constitution, 2010, states that every person has social, economic and environmental rights including equitable sharing of accruing benefits from natural resources (Kenya constitution, 2010). The Mining Act of 2016 categorised several mineral rights which would empower the holder to engage in mining activities. One such right was the issuance of a licence to any person or entity for large scale operations, and a mining permit to small scale operations. The mining act has also legalized artisanal mining operation under the new legal framework although essentially reserved for citizens of Kenya. Hence individuals, groups, cooperatives or associations may apply for an artisanal mining permit. The study sought to analyse the impacts of mining on the communities living around an exploration and mining

operations area as well defined by the mining act. The act also adds that a community is a group of people displaced from land intended for exploration and mining operations. While this same mining act addressed many regulatory key areas for development of the country's mining and mineral industry implementation of the same, it is yet to be realized. One most important provisions, among others, dealt with health, safety and environment issues as they relate to mining (Mining Act 2016). This is the gap that informed the genesis of this research.

One of the necessary pre-condition for sustainable development is a sustainable peace. Inclusive policies and measures that ensure communities fully participate in conserving and deriving benefits from their local natural resources need to be developed. The absence of this might invite restlessness and conflict with outsiders, which the country would have to contend with sooner or later (Mghanga, 2011).

CHAPTER THREE: GENERAL MATERIALS AND METHODS

3.1 Study Area

This study was carried out in Kamtonga and Mkuki areas of Mwatate sub-county, Taita Taveta County between January 2016 and April 2019. These minefields were easily accessible and treated as representative samples of the minefield scattered far and wide in Taita Taveta. Also, the logistics of reaching the two areas were much easier than for the less accessible e.g. Kasighau or Kuranze. In terms of costs, the two minefields fitted the bill for the researcher who funded the project. It is located in the South-Western part of Kenya, with a distance of 360 kilometres from Nairobi and 200 kilometres from Mombasa to the South East and North West respectively. Taita Taveta is surrounded by counties such as Kitui, Makueni and Tana River in the North; Kwale, Kilifi in the East, and Kajiado in the Northwest. It also borders The Republic of Tanzania towards the South West.

It has an altitude range of 500-2300m above sea level, and it receives rainfall to an average of 440-1900mm. The average temperature in the County is 23^0C. The total size of Taita Taveta County is 17,083.9 km² with a big part of it, (62% or 11,100 km²) forming the national parks of Tsavo East and Tsavo West. Ranches, sisal estates, water bodies such as Lakes Chala and Jipe in Taveta and Mzima springs cover the remaining 5,876 km², and forests occupy less than 100 km². Three topographical zones identify Taita Taveta County. The upper zone for horticultural farming is on altitude range of 304 meters-2,208 meters above sea level. Plains ranches, national parks and mining are located at the lower zone. Taveta region in volcanic foothills zone. The area has potential for underground water and springs from Mt. Kilimanjaro (Rop, 2015). The study focused on Mwatate sub-county at Kamtonga and Mkuki minefields based on the lower zone of Taita.
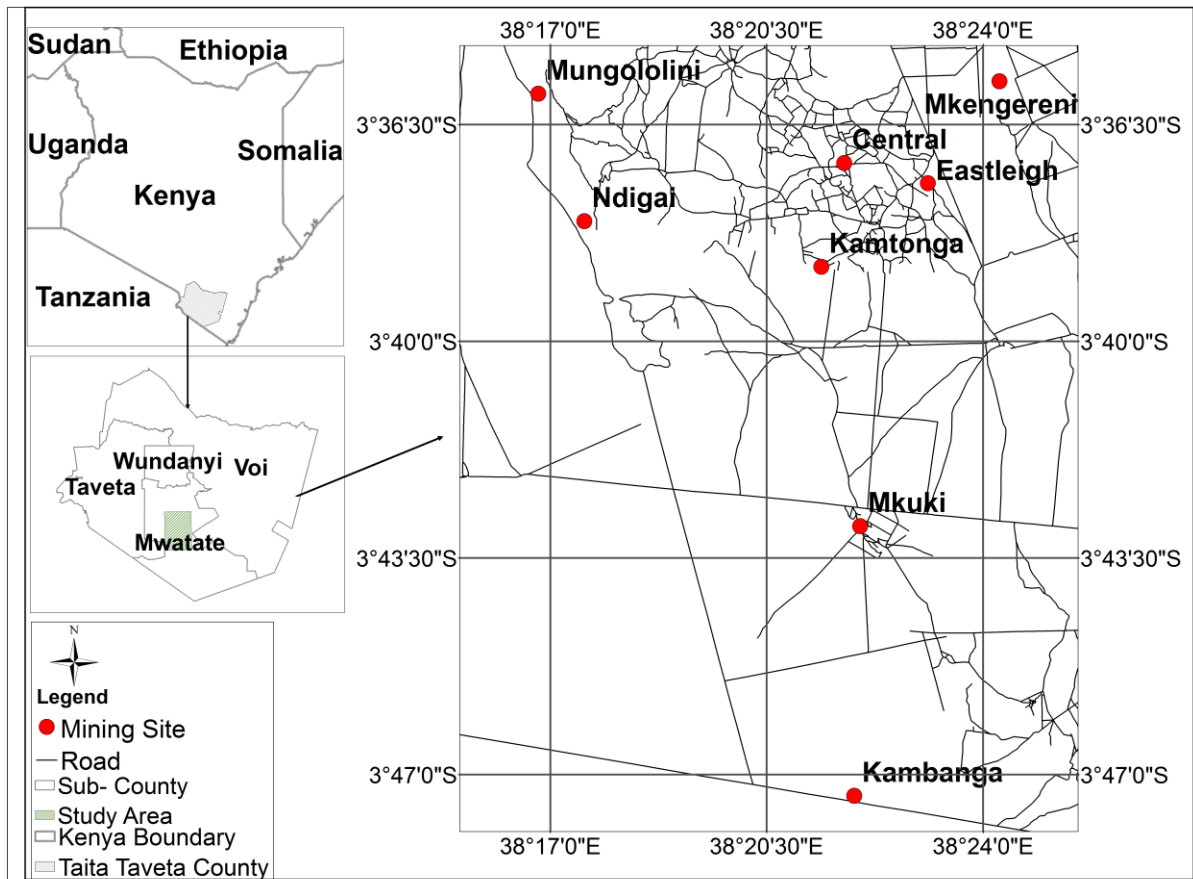
Figure 1: Map of the Study Area

3.2 The Geology of the study area

Taita Taveta is rich with a lot of minerals making it a leading producer of all the minerals produced in Kenya Taita Taveta County Integrated Development Plan (2018). Taita Taveta County falls between the Mozambique belt and the tertiary volcanic belt (Rop, 2014; Taita Taveta County Integrated Development Plan, 2013). According to geologist experts, the County is the main source of Tsavorite and ruby. Industrial minerals like iron ore, limestone, marble, magnetite, asbestos, graphite, kaolin clay and mica found in Taita Taveta (Taita Taveta County Integrated Development Plan, 2013).

3.3 Research design

The descriptive and content analytical approach was applied to assess the linkage between mining and the three components impacting the communities' socio-cultural heritage, livelihoods, and environment. The research was conducted by applying qualitative and quantitative methods including Key Informant (KI) discussions. The target audience, who included miners, was drawn from residents in the villages of Kamtonga and Mkuki, while Key Informants were purposively selected from related disciplines comprising of representatives of key stakeholders, County Government officials, Government ministries, Community Based Organizations (CBOs), and Kenya Forest Service (KFS). A survey on extractive industries and its implication on the community livelihoods were conducted even with the knowledge that this is an area that is shrouded in secrecy. Gender representation of respondents was ensured.

3.4 Target Population

Mugenda & Mugenda (1999) definition of the population is "the aggregate of all that conforms to a given specification". Population refers to an entire group of individuals, events or objects having common observable characteristics. Population for this study was drawn from the mining communities living in the villages around the mining areas and who bear the brunt of mining activities. They comprised of randomly selected households and purposive selected key informants.

3.5 Sampling Design

The study applied random and purposive sampling to select respondents and mining areas respectively. According to the (KNBS 2019) census, the population in Taita Taveta County was 340,671 with Mwatate's population being 81659. This population was inclusive of people from Kamtonga and Mkuki the selected research areas from where the study population was

drawn from 990 households. The sample size of 173 households was derived from the known population, using the formula below (Booth *et al*., 2003):

$$n = \frac{(z^2 \times p \times q \times N)}{e^2 (N - 1) + (z^2 \times p \times q)}, \text{ where:}$$

n = Sample size (being determined)

N = Population size (known)

p = Sample proportion (assumed to be 0.02, if not given)

q = 1 − p

e = 0.02 (since the acceptable error should be 2%)

z = Standard deviation at a given CI (z = 1.96 at 95% CI)

Purposive sampling method was used to focus on environmental characteristics around Kamtonga and Mkuki mining areas. These included nine mines comprising of large, semi and fully mechanized mining groups, small artisanal mining groups and individuals doing manual mining and surface mining in Kamtonga and Mkuki areas of Mwatate sub-county. Selection of key informants was done by purposive sampling considering the fact of individuals having common observable characteristics concerning the effects of mining.

3.6 Data Collection

Data was collected from communities' households using structured and semi-structured questionnaires through mobile technology. The questionnaire was pretested with ten (10) quarry miners. This helped to establish the consistency of the set questionnaire in terms of the time and location, from mobile technology. A key informant discussion was conducted with the County government officials, Kenya Forest Services County Ecosystem conservator (KFS), Community Based Organizations (CBOs), Artisanal and Small-scale mining (ASM), Kenya Wildlife Service (KWS), Mining stakeholders and National Environment Management

Authority (NEMA). Discussion sessions were audio-recorded with permission on a one-on-one basis. All the respondents were assured of the confidentiality of their responses before collecting data. The literature review was obtained from secondary data on the selected area of study. Literature was reviewed, described, summarized, evaluated and clarified to determine the nature and theoretical base for the research. Questionnaires were used for data as inquiry documents for the study. Information gathered was treated with confidentiality from respondents who contributed to the findings of the study.

3.7 Livelihood Framework Analysis

Livelihood Framework analysis was adopted to show the interplay between mining and development (Ellis, 2000). The following were the 5 variables used in the study;

Table 3.2 Livelihood Framework Analysis

Capital	Variables used in the study
Human	Skills, knowledge, the ability to work and good health.
Social	Social Exposure and security
Natural	Biodiversity quality
Physical	Livelihood assets, health centres, infrastructure and commuting transport
Financial	Incomes, job creation and improved living standards

3.8 Statistical treatment of data obtained

Data gathered from the field, was coded and entered using Statistical Package for Social Sciences (SPSS). The mass of raw data collected was systematically organized in a manner that facilitated analysis. This is where questionnaires were assigned numerical values according to the mode of responses applied. The open-ended questions were categorized according to the answers given. Key informants data was transcribed and categorized in different themes

represented in the findings. Tables of frequency distribution percentages were used to represent

the data. The data was interpreted, discussed and recommended from the analysis concluded.

CHAPTER FOUR: MINING IMPACTS ON SOCIETY: A CASE STUDY OF TAITA TAVETA COUNTY, KENYA

ABSTRACT

Taita-Taveta County is rich with a wide variety of minerals in the world. Gemstones like Ruby, Tsavorite, Ruby and green garnets has caused many people to migrate to the area. These people came from within the county and from other parts of the country, greatly impacting the lifestyle of the local community. There was a need to understand how mining impacts on society and cultural values of a community. This study was carried out in 9 villages which included; Eastleigh A and B, Central, Ndigai, Mungololini, Mukengereni B and C, Mkuki and Kambanga. Respondents from 173 households from the villages were interviewed and discussions from 8 key informants who included: a Manager of Classic Mines, an official of Chawia Mining Community Based Organization (CBO), an individual manual artisanal miner, a retired senior Warden of Kenya Wild Life Service (KWS), Kenya Forest Service Manager, a gemologist from the Taita Taveta County government, Chief of Mwatate location and the County Director of National Environment Management Authority (NEMA). On a scale of 1-4 (1=strongly disagree, 2=Disagree, 3=Agree and 4=Strongly agree), the respondents agreed that there was a loss of their ancestral land, conflicts, dilution of Taita culture through mixed intermarriages, increased prostitution, alcoholism and high school dropouts. The study recommends review of the legal and policy framework governing mining in community areas and subsequent vigorous enforcement to maintain the good order of the public and to sustain meaningful traditions and culture to ensure conflict resolution and mining site ownership.

Keywords: Conflict, Culture, Household, Land, Mining

4.1 Introduction

Taita-Taveta County is rich with a wide variety of minerals in the world (Taita Taveta County Government, 2013). Mining attracts people from all over Kenya and Eastern Africa to the county (Anyona & Rop, 2015a). Small-scale mining plays a vital role in poverty eradication and contributes to the national and foreign exchange revenues of the country and many developing countries (Anyona & Rop, 2015b). Mining contributes to community development projects and provides employment even though it has had potential adverse impacts on cultural heritage, natural environment, society and health. The safety of mineworkers and communities adjacent to the mining operations has also been negatively affected. Some of the impacts include the displacement of local people from their ancestral lands, marginalization, and oppression of lower economic classes groups. This has been experienced in countries such as Ghana, Liberia, Sierra Leone, Malawi and The Democratic Republic of Congo (Hilson, 2011).

The opening of a new mine triggers a rural to urban migration among local farmers, when they lose their sustainable sources of survival, in this case, their farmlands. Mining activities affect social structures of communities when mining villages and towns attract large numbers of workers who are normally accompanied by their families. Tension and even violence occur due to social differences between the various groups. Mining causes reduced access to clean water and land, impacting negatively on people's livelihoods. Mining communities are exposed to harassment and insecurity at the mines. This state of affairs worsens when local people are not consulted or informed of a planned mine site and are excluded from decisions of where to locate the mines. Discontent fuels conflicts. Mining is a 'paradox of plenty' or a 'resource curse'. In Peru, mining brought about impacts like decentralisation, displacement and mining conflicts and ways of mitigating it are yet to be properly demonstrated (Azapagic, 2004). Peruvian history shows that the country has been inflicted with the resource curse for decades,

and this condition has delayed Peruvian economic and political development. The people who live near mining projects are often concerned about the environmental effects of such projects. Residents often do not benefit greatly from mining projects because they are poor negotiators, or because their local leaders do not always have their interests at heart and have limited access to judicial systems. Thus, if a mining company violates a regulation or an agreement it has with a community, the local people may have difficulty forcing the mining company to comply with regulations or live up to its promises. (Loayza, et al. 2013). This scenario is reflective to many countries rich with mineral resources including Kenya and in this case, the study area which is in Taita Taveta County.

Studies in Taita, have mainly dwelt on political economy, and recent research on socio-economic and environmental impacts on women was conducted in Kisagau mining zone in Taita Taveta County the mining area including prospects of mining and conflicts over land and mineral resources (Mwakumanya et al., 2016; Mghanga, 2011). Areas touching on the relationship between mining and gender, human rights, education, health, culture, environment, water, social and economic standing are inadequately addressed. The study, therefore, sought to examine the socio-cultural impacts of peoples' perceptions, interactions, way of living, education, beliefs and how the communities have responded to the demands of mining in Mwatate sub-county minefields of Kamtonga and Mkuki.

4.2 Materials and method

4.2.1 Area of study

This research was done in Kamtonga and Mkuki minefields, Mwatate sub-county in Taita Taveta County. The County is located in the South-Western part of Kenya's Coast, between the longitudes 37^0 $30^{'}$ and 39^0 $30^{'}$ East and latitudes 2^0 $30^{'}$ and 4^0 $30^{'}$ South. The distance from

the Southeast of Nairobi is 360 km and approximately 200 km Northwest of Mombasa. It borders Kilifi and Kwale counties to the East; Makueni, Kitui and Tana River counties to the North; Kajiado county to the Northwest; and the Republic of Tanzania to the Southwest (Rop, 2014). Taita Taveta receives about 400mm of rainfall annually and 23^0c mean temperature (Taita Taveta County Government, 2013). It lies on the geographical coordinates of 3^0 $30^{'}$S, 38^0 $23^{'}$E. Taita Taveta is divided into three major topographical zones. The upper zone, suitable for horticultural farming comprises of Taita, Mwambirwa and Sagalla hills region with altitudes ranging between 304 meters and 2,208 meters above sea level. The lower zone consists of plains where there is ranching, national parks and mining. The study covered Mwatate sub-county where mining sites and industrial minerals are scattered in Kamtonga, Mgeno, Chawia and Chungaunga and Mkuki minefields.

4.2.2 The Geology of the study area

The county covers an area of 17,084.1km^2 and lies between latitudes 2^0 $46^{'}$ east and 30^0 $14^{'}$ East. According to Anyona & Rop (2015), Taita Taveta County mines follow a belt known as the Mozambique belt where forty high-value gemstones are found. The mineral-rich areas under this belt are listed as Taita Hills, Mwatate, Kasigau and Kuranze areas among others. Taveta region of Taita Taveta County is covered by a volcanic belt. Popular mines found in Taita are red garnets, green garnets, yellow garnets, green tourmalines, yellow tourmalines, change colour, blue sapphire, pink sapphire, amethyst, peridot, iolite, spinel, rhodolites and kynites, to list a few (Mwakumanya *et al*.,2016; Rop, 2014). The County emerges as the only main source of Tsavorite and ruby minerals worldwide.

4.3 Data collection

4.3.1 Quantitative and Qualitative Data

Quantitative data involved data collection from the field mainly from questionnaires using both closed and open questionnaires. The qualitative data was mainly from key informants that were given in the form of narrative on various identified thematic areas.

4.3.2 Survey questionnaire

Structured questionnaires were administered to target random respondents of 173 households drawn from nine villages included; Eastleigh A and B, Central, Ndigai, Mungololini, Mukengereni B and C, Mkuki and Kambanga. Identification of respondents was based on gender, age, education and occupation to collect quantitative data. Mobile technology was used to collect the data.

4.3.3 Sample size determination

To derive to the sample figure of 173 households from the known population, the researcher used this formula (Booth *et al*., 2003):

n = $\underline{(z^2 \text{ x p x q x N})}$

$e^2 (N - 1) + (z^2 \text{ x p x q})$, where:

n = Sample size (being determined)

N = Population size (known)

p = Sample proportion (assumed to be 0.02, if not given)

q = 1 − p

e = 0.02 (since the acceptable error should be 2%)

z = Standard deviation at a given CI (z = 1.96 at 95% CI)

4.3.4 Identification of KID respondents

Respondents for key informants' discussions were selected using a purposive method and based on their exposure to the mining operations in the study area. These comprised of Manager of Classic Mines, an official of Chawia Mining Community Based Organization (CBO), an individual manual artisanal miner, a KWS retired senior Warden, the KFS Manager, a gemologist from the Taita Taveta County, Chief of Mwachabo ward in Mwatate and NEMA County Director.

4.3.5 Key informant discussion guide

A guide for the discussion was developed that guided the researcher in discussions with key informants. The main focus was on the land ownership, community and social behaviour, tradition and cultural activities and religion.

4.3.6 Data analysis

Statistical Package for Social Science (SPSS) version 21.0.was used to code and analyze the survey data. The description took two scenarios of historical aspects before mining started and the scenario after the mining started. The data was represented in the form of percentages, frequencies, means and Cross tabulations. Key informants data were transcribed and data categorized in different themes represented in the findings.

4.4 Results and Discussion

4.4.1 Respondent Age, Gender, and Education

Majority of the respondents were between 36-45 years of age (Table 6.1). The study sought to establish the education level and age concerning gender. Most of the respondents were male, comprising of 56.6% with 43.4% of the female respondents. The males had attained more

formal education (p>0.05). Of the males' respondents, 39.4% and 14.3% had attained primary and secondary level respectively. Regarding the female respondents, 28.0% had attained primary level and 6.9% had no formal education. This indicates a lower transition from primary to secondary school among girls hence reduced enrollment in secondary schools due to mining activities in the area. Interviews conducted revealed school dropout among girls to engage in food vending in mining areas while others dropped out due to early pregnancies and prostitution. In Migori, Vihiga and Magarini, socio-economic factors have contributed to rising school dropout rates (Nyamweno et al., 2015; Ocholla et al., 2013, Omollo, 2013). Similar findings have also been reported showing a low transition of girls compared to boys from primary to secondary level to pursue employment in the mining sector (Yakovleva, 2007). Also due to economic household constraints and high opportunity costs of educating a girl child compared to a boy, girls dropping out of school seem to be an acceptable norm (Amina, 2015; Quadri & Kalyankar, 2010).

Table 4.1: Respondent Gender, Education and Age

Category of Age and Education		Male		Female		Total		p-Value
		n	%	n	%	n	%	
Education	None	2	1.1	12	6.9	14	8.0	
	Primary	69	39.4	49	28.0	118	67.4	
	Secondary	25	14.3	10	5.7	35	20.0	0.02
	Tertiary	3	1.7	5	2.9	8	4.6	
Age	16-25 Years	11	6.3	12	6.9	23	13.1	
	26-35 Years	25	14.3	18	10.3	43	24.6	
	36-45 Years	27	15.4	26	14.9	53	30.3	
	46-55 Years	16	9.1	6	3.4	22	12.6	0.119
	56-65 Years	8	4.6	11	6.3	19	10.9	
	>65 Years	12	6.9	3	1.7	15	8.6	

4.4.2 Social-cultural aspects of people living near mining areas

Mining affected the socio-cultural dynamics of people living close to the mining areas in Taita-Taveta County. There were historical and recent impacts on society and culture. The historical

impacts on culture were not purely associated with mining and traditional concepts. Traditional values of the indigenous people tended to disappear as people were forced to look for other sources of socioeconomic gains to meet their livelihood. Similarly, the responsibility to protect ancestral cultural heritage and economic development prospects remain divided among the communities elsewhere (Wetzlmaier, 2012). However, recent cultural evolution could be directly related to mining as it causes loss of land hence loss of strong socio-cultural ties and identity of the indigenous communities. Some of these social-cultural changes, as perceived by respondents, are reflected in Table 4.2 on a scale of 1 to 4 *(1-strongly disagree, 2-Disagree, 3-Agree, 4-Strongly Agree).* The key ones included land ownership, community and social behaviour, tradition and cultural activities, religion and morality.

4.4.3 Indigenous Land Ownership

Historically, land according to respondents was owned by the indigenous people living within its locality communally and was termed as ancestral land. The form of land tenure was not clear as some respondents considered all land that people lived on as communal land. So although from the survey, engagement in mining activities led to loss of land by some, there lacked evidence as others reportedly leased their land to miners (Table 4.2).

Table 4.2: Indigenous Land Ownership

Indigenous Land Ownership Before Mining	Gender	Education Level				Total
		None	Primary	Secondary	Tertiary	
The land was owned by local people	Female	3.0	3.1	3.0	3.0	3.0
	Male	3.0	2.8	2.9	3.3	2.9
Inherited ancestral land	Female	3.0	3.0	2.8	3.0	3.0
	Male	3.0	2.8	2.7	3.7	2.8
Local people lived on communal land	Female	3.0	2.9	2.6	3.3	2.9
	Male	3.0	2.8	2.5	3.0	2.7
Local people leased land and lived there	Female	3.0	2.9	2.6	2.3	2.8
	Male	3.0	2.6	2.6	2.3	2.6
Indigenous Land Ownership After Mining						
Loss of land to mining	Female	2.6	2.6	2.6	2.3	2.6
	Male	3.0	2.6	2.6	2.3	2.6
Leased land to miners	Female	2.6	2.7	3.0	2.7	2.7
	Male	3.0	2.9	2.8	2.3	2.8

(Scale: 1-Strongly Disagree, 2-Disagree, 3- Agree, 4- Strongly Agree)

One of the owner of a mining site reported, "immigrants is in large numbers than locals in Kamtonga mining site. People around the area have lost their ancestral land to the mining sector. One of the ranches by the name Wananchi Ranch has a court case to this day because after the owner died people started to mine by force hence other family members are unable to acquire it''.

People of Taita-Taveta County were rich before the mining started, though their wealth was

People of Taita-Taveta County were rich before the mining started, though their wealth was

derived from crop and animal agriculture (Mwakumanya *et al*., 2016; Mwanyumba *et al*., 2010). However, with the advent of mining, in the 1960s, the land was alienated from the local people. The gemstones mining created an influx of outsiders resulting in loss of control of the vast communal land and also to some people losing their ancestral land to mining activities

(Anyona and Rop, 2015a&b). Citing the case of Geita mine, Kitula (2006) reported that extraction of minerals often resulted in grabbing of lands from indigenous people leading to the displacement of residents. In that case, about 1800 residents were forced to move from indigenous land, losing their agricultural, grazing lands and mine sites. Frequently, more financially endowed foreign miners, in comparison to local people, can secure more land rights. However, the data in this study did not verify this as factual as respondents remained fairly neutral to the question of land ownership as affected by mining.

4.4.4 Communal /social relations

Traditionally, Taita Taveta County, people lived in villages among their clansmen and had strong family units. Children played on one compound peacefully together and communities shared in activities such as cooking. There was a consensus on communal and social aspects between the non-educated and educated respondent (Table 4.3).

Table 4.3: Communal/Social Relations (Peaceful Habitation)

Communal /social relations (Peaceful Habitation) before mining

Communal /social relations	Gender	Education Level				Grand Total
		None	Primary	Secondary	Tertiary	
People lived in villages	Female	2.9	3.0	3.0	3.7	3.0
	Male	3.0	2.9	2.6	3.0	2.8
Strong family unity	Female	3.0	3	3	3.3	3
	Male	3.0	2.9	2.8	3.3	2.9
Children played on one compound peacefully together	Female	2.9	3	2.8	3.3	3
	Male	3.0	2.9	2.6	2.7	2.8
Communities cooked and ate together peacefully	Female	2.9	2.9	2.8	3.3	2.9
	Male	3	2.9	2.6	2.7	2.8

Communal /social relations (Peaceful Habitation) after mining

Mining activities disrupted peaceful habitation in the villages	Female	2.4	2.6	3.0	2.7	2.6
	Male	3.0	2.5	2.7	3.0	2.6
Families no longer spend time together because of working at the mines	Female	2.7	2.7	3.0	3.0	2.7
	Male	3.0	2.8	2.8	3.5	2.9
Children lives have been interfered with by the changed family occupation	Female	2.7	2.6	3.0	2.7	2.7
	Male	3.0	2.7	2.8	3.5	2.7
Sharing community or extended family activities has been disrupted	Female	2.7	2.8	3.0	2.7	2.8
	Male	3.0	2.8	2.8	3	2.8
People have become busier than before with both employment and farming	Female	3.0	3.1	3.0	3.3	3.1
	Male	3.0	3.0	3.2	3.0	3.1

(Scale: 1-Strongly Disagree, 2-Disagree, 3- Agree, 4- Strongly Agree)

After mining started, family units disintegrated with loss of their land to mining and family members were dispersed from their villages. Thus mining activities disrupted peaceful habitation in the villages and family members no longer spent much time together as mining

activities kept them away from home. Consequently, children have to cope with their parents' absenteeism. Open land to prospect is diminishing resulting in social conflict between displaced residents and mine operators, including large scale mining companies. Profound conflict among mineral stakeholders suggests that there are weak or inadequate policy and legal framework for mining or that if it exists, its enforcement is poor (Kitula, 2006). Regulations are required to focus on conflict resolution and mining site ownership.

4.4.5 Traditional / Cultural Activities

Historically, people upheld their important traditional, social and cultural activities including communal hunting and gathering, and cultural dances that occupied their leisure time and social events such as childbirth, child naming and weddings. The Taita people had their own dressing culture that differed between men and women. The influx of new people into the county eroded these traditions and culture. Most of the traditional cultural activities of the Taitas living around mining areas have disappeared as a result of changed occupations, dispersion, and interaction with different peoples and with discreet and reserved behaviour expected and usually observed around mining. The latter has eroded natural trust, traditionally common among the Taitas. The mining areas have become cosmopolitan with economic gains altering the dressing and music cultures of the Taita Taveta people living in the mining areas.

It is no longer secure to have open ceremonies in the nights like before due to insecurity reasons. Findings below indicate that Taita communities had already been into religion mainly Anglican, Catholic and Muslim and they also had their own sacred beliefs before mining activities began. On the onset of mining activities, sacred beliefs and artefacts have no prominence anymore and religious platforms have also changed with more protestant churches in the mining areas (Table 4.4).

Table 4.4: Traditional/Cultural Activities before and after Mining

		Education Level				Total
	Gender	**None**	**Primary**	**Secondary**	**Tertiary**	
People upheld their traditional and cultural activities	Female	3	3.1	2.8	2.7	3
	Male	3	2.9	2.7	3.3	2.9
Cultural dances occupied leisure time	Female	3	3	2.8	2.7	2.9
	Male	3	2.8	2.6	2.7	2.8
Events like weddings, childbirth, and child naming were very important for families	Female	3	3	3.2	3	3
	Male	3	3	2.9	3	3
Taita people had their own dressing culture for men and women	Female	3	2.9	2.6	2	2.8
	Male	3	2.8	2.6	2.3	2.7
Hunting and gathering was part of peoples important social activity	Female	3	2.8	2.8	2.3	2.8
	Male	3	2.8	2.8	3	2.8
Traditional/Cultural After Mining						
The onset of mining brought in an influx of none residents into the county	Female	3	3.2	3	3.3	3.2
	Male	3	3.3	3.3	3.7	3.3
Tradition and culture has been altered because of the presence of a mixed population	Female	3.1	2.9	3.2	2.7	3
	Male	3	2.9	2.9	3.3	2.9
Communities no longer live in trust because of secret remunerations supposedly given	Female	2.6	2.7	2.8	2.7	2.7
	Male	3	2.7	2.7	3	2.7
Most of the cultural activities of the Taitas living around mining areas have died due to the changed occupations in the area	Female	3	2.8	3.2	3.3	2.9
	Male	3	2.9	2.9	3.7	2.9
Mining areas have become cosmopolitan	Female	3	3.1	3	3.3	3.1
	Male	3	3.1	3.1	3.7	3.1

Economic gains have altered the dressing and music cultures of the Taita Taveta people living in the mining areas	Female	3	2.9	2.8	3	2.9
	Male	3	2.8	2.8	3.3	2.8
It is no longer secure to have open ceremonies in the nights like before	Female	2.6	2.6	2.6	2.3	2.6
	Male	3	2.6	2.5	2.7	2.6
Sacred beliefs and artefacts have no prominence any more	Female	3.1	3	3	3	3
	Male	3	2.9	3.1	2.3	2.9
Religious platforms have also changed with more protestant churches in the county	Female	3	2.9	3	3.7	3
	Male	3	3	2.9	3	3

(Scale: 1-Strongly Disagree, 2-Disagree, 3- Agree, 4- Strongly Agree)

Gemologist reported, *''increased immigrants have brought about insecurity in the areas with increased reported cases of theft within the mining centres. No trust in the families as miners get a lot of money but this money doesn't go down to families''.*

From the key informants' discussion, people lived in peace, but with the influx of people from other counties, insecurity has become a factor in these areas. Similarly, Kitula (2006) also alludes that there have been some negative mining impacts in Geita District in Tanzania. These included displacement and unemployment, child labour, accidents and theft. High influxes of migrants in search of jobs also brought about prostitution and culture changes including internal competition for natural resources.

4.4.6 Moral Behavior

The results in Table 4.5 showed that when it comes to behavioural patterns the mining environment has introduced new lifestyles to the communities. Both formal and informal education existed before mining and boys and girls went to school. As mining started the study revealed escalation of girls drops out from schools to engage in prostitution. Gainful

remunerations have encouraged alcoholism and drug addiction which has resulted in the rise of family neglect, coupled with divorces and polygamous habits. The study findings revealed that mining activities have devalued the moral values of the people, which were highly upheld before mining started. During that time men and women did not mix in public village meetings and churches as a sign of respect. Sex education was sacred and aunties and uncles took the mantle to talk about it to the youth (Table 4.5).

Table 4.5: Moral Behaviors

Moral behaviours	Gender	None	Primary	Secondary	Tertiary	Grand Total
Mining has introduced a new lifestyle to the communities	Female	3	3.1	3	3.3	3.1
	Male	3	3	3	3.3	3
Alcoholism and drug addiction has escalated	Female	2.7	3.1	2.8	3.7	3
	Male	4	3.2	2.9	3.3	3.1
More girls are dropping out of school to do prostitution	Female	2.7	2.9	3	3.7	3
	Male	3	3.1	2.9	3.3	3
Family neglect is on the rise	Female	2.7	2.9	3	3.3	2.9
	Male	3	2.8	2.8	3	2.8
Also, divorces and polygamy habits are on the rise	Female	2.7	2.9	2.6	3.7	2.9
	Male	3	2.8	3	3.3	2.9

(Scale: 1-Strongly Disagree, 2-Disagree, 3- Agree, 4- Strongly Agree)

Chief in the area said, ' *'Schoolchildren disappear from schools to engage in mining activities. People are engaging in alcohol drugs and prostitution in the area. Additionally, in Mkuki area, prostitution is high with a high rate of HIV/AIDS spread. Families are breaking up due to financial constraints since it is not every day that one gets the gemstone in the mining areas. For the last two months, we've been fighting chang'aa''(a local brew).*

From the key informants, it was evident that mining activities have impacted most of the areas either positively, or negatively. Although most respondents agreed their lives have improved from sales of minerals, they still complained about the high numbers of immigrants, use of

alcohol and drugs, high levels of school drop-outs especially among the girls and prostitution that has escalated in mining areas. Mining activities have caused high numbers of immigrants in search of jobs. This has brought drastic change to community lifestyle as mixed communities from other parts of the counties and country diluted the Taita culture. Additionally, it has led to increased prostitution and natural resources competition among the local dwellers. According to Kitula (2006), mining activities is a contributor to high prostitution level which translates to the spread of transmittable diseases like HIV and AIDS in mining regions. Similar findings were reported by Mwakumanya *et al*. (2016) concerning a high rise of family breakages and loss of family values at the mining sites.

4.5 Conclusion

Mining has brought both positive and negative effects on the sociocultural aspects of Taita Taveta County. The mining sector has brought in an influx of none residents in the area in search of jobs and the area has become cosmopolitan. Negatively mining has introduced a new lifestyle to the communities resulting in conflict issues, high rate of alcoholism and drugs addiction, high levels of school drop-outs especially among the girls, prostitution, dilution of the Taita culture and devalued moral values of the people. There is a need for community sensitization on the importance of education. Implementation of mining regulations is crucial.

CHAPTER FIVE: MINING IMPACT ON COMMUNITY LIVELIHOODS: A CASE STUDY OF TAITA TAVETA COUNTY, KENYA

ABSTRACT

The study aimed to assess the impacts of mining activities on the livelihood of communities in Mwatate Sub-county, Taita Taveta County. Data of sampled households in nine villages were gathered and analysed. Livelihood Framework analysis was adopted to show the interplay between mining and development within the five variables namely social, economic, physical, natural, and human capital. The research method included structured questionnaires administered through a mobile technology and one-on-one focussed discussions with key informants. The study revealed varied mining effects concerning the migration of communities from other counties into mining areas of Taita. Open mining pits and large-scale mining have caused the loss of agricultural land resulting in reduced crop yields and living standards. Even though mining fell short of creating wealth in the form of assets that generate income to the people, it enhanced ability to meet day to day needs for the communities. Taita Taveta County recorded a higher monthly income of Ksh. 46, 468 from mining, followed by Machakos County Ksh.18, 500 compared to Makueni, Kilifi, Kitui and Tana River counties. The study recommends diversification of economic activities to enhance livelihood improvement and also enforcement of environmental and social impact assessment as a legal framework that would regulate the mining operations in Taita-Taveta County.

Keywords: Impact, Livelihoods, Mining, Poverty, Wealth

5.1 Introduction

Mining operations, whether large scale or small scale have potential impacts on the people's livelihoods as it employs people in the proximity where minerals are being exploited (Hilson, 2019). Mining is believed to be a major economic activity in Taita Taveta County (Mwangi & Mutiso, 2018). It is a driver for job creation resulting in improved livelihoods. It also boosts the economy of Kenya through the generation of revenue for example, through infrastructure development (Horsley *et al*., 2015). Mining sector creates a pool of opportunities that can be relied on by the county government for socio-economic development and creation of wealth. While Small Scale Mining has got a major potential in reducing poverty and contribute to sustainable development, it also has impacts in the areas of environment, social and economy that may negatively affect developments and livelihoods of local communities (Pedro, 2004). Social and environmental sustainability for the benefit of future generations is rarely considered during extraction processes (Baru & Moronge, 2018). Generally, mining is blamed globally for harmful and impoverishing effects, and hence governments are expected to regulate mining in a manner likely to attract investors and at the same time protect interests of local communities (IIED, 2002).

In Kenya, various types of minerals are found where only a few are being exploited (Davies & Osano, 2005). Taita Taveta County is rich in gemstones and minerals which could potentially generate wealth for the prospectors, investors and local community members (Rop, 2014). Others include; titanium, barites, coral rock, salt, iron ore and gypsum that exist in the Taita Taveta mineral ore belt (TTCG, 2013). However, in Taita Taveta, mining often is carried with little government regulation or control, there being few rules on sharing of royalties and benefits among the investors, the communities, the county and national governments (Mohamed *et al*., 2019). The extraction freedom has attracted people from all over Kenya and

East Africa to Taita, but only a few locals are involved, largely benefiting only brokers, middlemen and other players along the supply chain thus unverified claims of exploitation of the environment and the local communities by miners have been made (Rop, 2014). Exploitative systems are unlikely to be sustainable (World Commission on Environment and Development, 1987). But the combination of socio-economic growth and development, improved environmental protection, and pollution prevention may be considered as sustainable development (Hilson & Murck, 2000).

Socioeconomic impacts on national and county economy at large have a significant proportion towards the national mining production generated from ASMs. However, studies concerning exploitation in the area have been inconclusive, presenting variable findings on the effects it has on various actors in the mining activities (Anyona & Rop, 2015a&b). Accurate information on the number of artisanal and small scale miners is difficult to obtain in the county where ASM activities are considered illegal and informal (Hentschel, 2003). According to Mghanga (2011) research concentrated on the political economy of the mining area associated with conflicts over land and mineral resources. There is scanty information documented concerning the impact of mining on communities living in mining environs of Taita Taveta County. This resulted in the need to carry out a research study concerning the prevailing mining issues impacting livelihoods on communities residing around mining areas of Kamtonga and Mkuki.

5.2 Materials and method

5.2.1 Area of Study

The study was done in Taita Taveta County, at the minefields of Kamtonga and Mkuki areas of Mwatate sub-county, between January 2016 and April 2019. The coordinates of the study area are Latitude 03°.72'11.1"S and Longitude 38°.37'20.2"E. The county altitude ranges between

500-2300 meters above sea level. Taita Taveta is 360 km from Nairobi and 200 km from Mombasa to the South East and North West respectively. Other counties bordering Taita Taveta are to the North, Kitui, Makueni and Tana River. Towards the East, there is Kwale and Kilifi and to the Northwest there is Kajiado. The Republic of Tanzania is found in the Southwest. It receives rainfall to an average of between 440-1900mm. The total size of Taita Taveta County is 17,083.9 km². Out of this total size 11,100 km²) form the Tsavo East and Tsavo West National Parks. Ranches, sisal estates, water bodies such as Lakes Chala and Jipe in Taveta and Mzima springs cover the remaining 5,876 km², while, forests on the hills of Taita occupy less than 100 km. Three topographical zones are the identity of Taita Taveta County. The upper zone is suitable for horticultural farming and it comprises of Taita, Mwambirwa and Sagalla hills with an altitudes range of 304 meters and 2,208 meters above sea level. Plains, ranches national parks and mining are located at the lower zone. The third topographical zone covers Taveta region which although with volcanic features, has a potential for underground water and springs from Mt. Kilimanjaro.

The mining fields sampled were Kamtonga, and Mkuki in Mwatate Sub-county (Figure 1). These minefields were easily accessible and treated as representative samples of the minefield scattered far and wide in Taita Taveta. Also, the logistics of reaching the two areas were much easier than for the less accessible e.g. Kasighau or Kuranze. The two sampled mining fields are surrounded by ranches including Kutima, Choke and Kabanga that keep livestock herded by Maasai and Somali employees who roam the vast land parcel. Kamtonga and Mkuki townships are fast growing into vibrant commercial centres and dwellings that accommodate the cosmopolitan gemstone miners and dealers. Also, itinerant dealers move in, twice a week from as far away as Tanzania for the gem auctions that take place at the Chawia Mining Community Based Organization (CBO).

5.2.2　Geology of the Study Area

Taita Hills, Mwatate, Kasigau and Kuranze of Taita region, are some of the mining areas within the Mozambique belt. Taveta region is covered by the Tertiary Volcanic belt. Taita Taveta County is the main source of Tsavorite and ruby minerals worldwide.

5.3 Population and Sampling

5.3.1 Study Population

According to the Kenya National Bureau of Statistics (KNBS, 2019), the population of Taita-Taveta County is 340,671, having grown from 284,657 in 2009. Mwatate Sub County population has an estimate of 1.95 per cent of the county population which has grown to 81659 people (KNBS, 2019) partly because of people migrating to town to establish businesses especially trading in precious stone called Tsavorite, found plentifully around Mkuki and Kamtonga areas. The population in the nine villages of Kamtonga and Mkuki comprised of indigenous, non-local Kenyans and non-Kenyans forming a pool of cultural diversity. Most of the people have lived in these areas for over 20 years having come from Taita Taveta, Makueni, Murangá, Nakuru, Tharaka-Nithi, Kilifi, Nandi, Siaya, Kiambu, Tanzania, Burundi, Kitui, Mombasa, Machakos, Tana river, Kisumu, Meru, and Nyeri counties.

5.3.2 Sampling

To derive to the sample figure of 173 households from the known population, the researcher used this formula (Booth *et al*., 2003):

$n =$ $\underline{(z^2 \text{ x p x q x N})}$

$e^2 (N - 1) + (z^2 \text{ x p x q})$, where:

n = Sample size (being determined)

N = Population size (known)

p = Sample proportion (assumed to be 0.02, if not given)

q = 1 – p

e = 0.02 (since the acceptable error should be 2%)

z = Standard deviation at a given CI (z = 1.96 at 95% CI)

Among the 173 households were formal miners, mineral brokers, small traders, transporters and food vendors who were treated as sampling frame strata. Within each stratum, respondents were selected randomly from a list generated from participatory community household mapping, but biasing it to include gender (males and females), age and education level (none, primary, secondary and tertiary) within represented ethnic groups. The people-based livelihood study targeted nine villages (Table 5.1)

Table 5.1: Households from nine villages in Mwatate Sub-county

No	Villages (Strata)	Number of Households	Sample Households
1.	Eastleigh A	85	15
2.	Eastleigh B	75	13
3.	Central	80	14
4.	Ndigai	120	21
5.	Mungololini	200	35
6.	Mukengereni B	80	14
7.	Mukengereni C	110	19
8.	Mkuki	200	35
9.	Kambanga	40	7
	TOTAL	**990**	**173**

Respondents were randomly selected to cutting across occupations such as farmers, teachers, vendors, shop/kiosk traders, retailers, business people, transporters, cattle herders, church and women's associations, miners, small scale and artisanal miners. There was also a registered

Community-Based Organization (CBO) which oversees and supports interested multicultural groups in mining.

5.4 Data Collection

5.4.1 Survey instruments

The questionnaires were administered to the representatives of 173 households drawn from nine villages in Kamtonga and Mkuki. In this study a household is considered to be a family or a group of people, living, cooking and eating together with one person regarded as the head of the house. The socio-economic variables assessed the impact of Small-Scale Mining to the economy, job creation, health centres, sustainable education system, security, commuting transport, social exposure, improved living standards, and infrastructure, incomes improvement and livelihood assets accessibility and involvement in social responsibility and religious activities.

The questionnaire and guided discussions were used to elicit information on the problem under study. This also helped the researcher to identify areas in the questionnaire that needed clarity for the respondent to understand and respond appropriately. Literature review formed part of the secondary data of this study. It helped to identify what was already known about the area of this study. Mobile technology was used as the tool to record the responses from respondents of sampled groups.

Also, a guide for the discussion was developed for the nine (9) key informants who comprised of Manager of Classic Mines, an official of Chawia Mining Community Based Organization (CBO), an individual manual artisanal miner, a retired senior Warden of Kenya Wildlife

Service (KWS), the Kenya Forest Service County Ecosystem conservator, a gemologist from the Taita Taveta County, the Chief of Mwatate location, and the NEMA County Director.

5.4.2 Data Analysis

Data on gender, income and livelihood opportunities were examined, organized and arranged in manageable units for analysis to establish accuracy of the research study, using Statistical Package for Social Sciences (SPSS) Version 21.0. The data were displayed on tables in the form of means and percentages for a clear understanding of the findings.

5.5 Results and Discussion

5.5.1 Gender proportion of respondents

Majority of the respondents were male engaged in mining activities (62.79%) compared to the female respondents who were least involved as miners (37.21%). Table 5.2 shows the proportion of males and females and their income source as interviewed during the survey. Both genders were equally involved in the business within the area. In terms of farming activities, females were the most involved (60%) compared to the male (50%). Also from the key informants, men were mentioned to be the majority in the mining sector.

Table 5.2: Gender proportions of respondents

Income Source	Gender		Total
	Female (%)	Male (%)	(%)
Business	50.00	50.00	100.00
Farming	60.00	40.00	100.00
Miner	37.21	62.79	100.00
Others	100.00	0.00	100.00
Total	**43.86**	**56.14**	**100.00**

Men are said to be the chief providers in the family thus forcing them to work tirelessly to ensure that they can provide for their family. Moreover, men are preferred more than women in mining sectors due to their masculinity. It is reported that males prefer to do hard work to increase the level of production, unlike the females who find it difficult to operate heavy machinery and equipment (Amutabi & Lutta-Mukhebi, 2001). There is a higher demand for males compared to women in mining even though this activity is gender-oriented (Kitula, 2006). This contradicts what is seen on the ground in the sense that as much as mining is perceived as the male activity, women are observed at the centre of mining (Caballero, 2017; Amutabi & Lutta-Mukhebi, 2001).

From the study, it was also realized that more women were operating shops while men did actual mining. According to Stevenson & St-Onge (2005), most of the women have eliminated the mentality that business and especially shops are for the male-only. More men were miners probably because mining activities required more masculine gender. Tundui, (2012), Olayide et al.,(2013). argued that differences in biological composition between male and female predetermined capabilities and dispositions for various activities that they did.

5.5.2 Proportion of respondents' source of income, gender and marital status

Part of the profile question was to indicate the marital status of the respondents from each category of occupation. There was more married male compared to the female. This is probably because most males at the mines came from the other parts of Taita leaving behind their families while in search of livelihood. Within the study areas, it was realized that respondents were occupied with various economic activities besides, mining and farming (Table 5.3). To identify the key occupations of the residents in Kamtonga and Mkuki, the respondents were asked to list the skills they possessed. Listed skills included Farming

(livestock, Poultry, land tilling), Mining (labourers, brokerage), business (shopkeeping, kiosks, selling of clothes, food vending, sand selling and transportation) other activities included brick making, house construction, teaching and community health workers. These are the activities that most respondents engaged in to support their household livelihoods. The results are similar to that of Aragon & Rud (2013) in Peru who reported that most local communities engage themselves in many different activities like business and farming to enable them to support their families.

Among the respondents, 85.3% of the male respondents and 64.0% of the female respondents earned their income from mining. However, females respondents were more engaged in farming 24.0% compared to 12.50% of male respondents while a few engaged in business (Table 5.3).

Table 5.3: Proportions of respondents' source of income, gender and marital status

Income Source	Marital status	Gender		Total
		Female	**Male**	
Business	Married	8.0	2.9	5.0
Farming	Divorced	0.0	2.9	1.7
	Married	24.0	8.8	15.3
Miner	Married	52.0	82.4	69.5
	Single	4.0	2.9	3.4
	Widowed	8.0	0.0	3.4
Others	Single	4.0	0.0	1.7
Total		**100.0**	**100.0**	**100.0**

In Africa, men are said to be the breadwinners and so they find themselves working harder (Behnke &Meuser, 2012). Despite more males engaging in mining, 12.5% of the male respondents are also engaged in farming. This means that some of the farmers are also engaged in mining for more economic gains which resonate with some of the communities

studied in Ghana where Adjei (2007) indicated that mining has contributed to economic and financial gains to some farmers.

5.5.3 Estimated average monthly income for different categories of respondents

The results in Table 5.4, indicates that most of the male respondents tended to earn more in business activities and mining compared to the female. Spiegel (2012) stated that women in the mining sector have minimal participation in the activity hence a low source of income. In this case, women are unable to engage in the mining sector adequately and tend to participate in farming and other activities such as food vending in the mining areas.

Table 5.4: Estimated average monthly income for different categories of respondents (in Kenya shillings)

Income Source	Gender		Grand Total
	Female	Male	
Business	8,000.0	10,000.0	18,000.0
Farming	5,333.3	6,000.0	11,333.3
Miner	6,250.0	6,666.7	6,511.6
Others	10,000.0	0.0	10,000.0

5.5.4 Average monthly income made by respondents from different counties and locations within Taita

Observations from different counties and location living within Taita and around the mining areas revealed that respondents from these counties also got involved in the three key activities namely business, farming and mining. The average actual monthly income varied considerably, showing communities from Makueni to lead in business activities with a monthly income of Ksh. 110,000. The Taita community and the locals led in mining with a monthly income of Ksh. 46,468.42 followed by communities that came from Machakos County (Table 5.5).

Table 5.5: Average monthly income made by respondents from different counties and locations within Taita

Counties	Income Source			Grand Total
	Business	**Farming**	**Miner**	
Taita	-	-	46,468.42	46,468.42
Machakos	-	-	18,500	18,500
Makueni	110000	500	11,157.14	121,657.1
Kilifi	-	-	9,000	9,000
Kitui	-	-	2,500	2,500
Tana River	-	-	800	800

According to Makueni County Integrated Plan (2015), people from Makueni County led in business activities in Taita Taveta County because in their County of origin development of market centres are limited by low economic activities. This is mainly because of over-reliance on agricultural activities, that often perform poorly due to recurring droughts, and that has forced them to shift to other income-generating activities such as business activities including cereal retailing, livestock, building materials and household products (Makueni County Integrated Plan, 2015). Taita people have more mining skills compared to the immigrants who led in income generation from the mining activities (Muigua, 2019).

5.5.5 Influence of Mining on livelihood opportunities

On a scale of 1-4 influence of mining on livelihood opportunities, respondents agreed that mining activities assisted in the creation of new business opportunities such as food vending, enlarged transportation and increased food security and could also create wealth (Table 5.6). However, mining did not help them in the acquisition of properties like land, cars and houses. This meant that mining enhanced ability to meet day to day needs but fell short of creating wealth in the form of assets that generate income to the people.

Table 5.6: Effects of mining on livelihood opportunities

Capital	Livelihood opportunities	Females	Males
Social Capital	Increased food security	3.0	2.9
Economic Capital	Created opportunities for women	3.0	3.0
	Enhanced food vending	3.0	3.0
	Created new business opportunities	3.0	3.1
	Improved farming	0.7	0.7
	Improved standard of living	0.1	0.3
	Creation of jobs	2.9	3.0
	Created markets for agricultural produce	2.9	2.9
	Increased incomes	2.5	2.7
	Enhanced security	2.9	2.8
Physical Capital	Enlarge transportation	3.0	3.0
	Enabled buying of houses	2.7	2.8
	Increased infrastructural developments	2.6	2.4
	Increased livestock ownership	2.4	2.6
	Enabled buying of mining tools	2.4	2.7
	Enabled buying of farming tools	2.4	2.6
	Enable build a good house	2.3	2.4
	Increased urban centres developments	2.7	2.9
Natural Capital	Enabled buying of land	2.4	2.5
Human Capital	Created wealth	3.0	3.0

(Scale: 1-Strongly Disagree, 2-Disagree, 3- Agree, 4- Strongly Agree)

Table 5.7 shows results that disapprove loss of assets contrary to the study in Ghana where mining operation caused a loss of livelihoods among the rural households (Adjei, 2007). This means that mining is an additional source of livelihoods.

Table 5.7: Mining maligned for negative effects disapproved

Negative mining impacts	Females	Males
Caused me to lose land and home	2.2	2.2
Low economic gain	2.5	2.4
Lost land	2.3	2.3
Lost trees	2.3	2.3
Lost Livestock	2.3	2.3
Reduced farming skills and activities	0.1	0.2
Reduced herding skills and activities	0.1	0.2
Reduced poultry rearing skills and activities	0.1	0.1
Reduced Beekeeping skills and activities	0.0	0.0

(Scale 1-Strongly Disagree, 2-Disagree, 3- Agree, 4- Strongly Agree)

According to Hilson & Banchirigah (2009), mining has got potential in poverty reduction however social and cultural heritage adversely impact communities close to mining operations. The environment, health and safety of mineworkers are also at stake. In Peru, mining adversely affected land and water resources, reducing access to piped water and contaminating major rivers (Bebbington & Bury, 2009). Mining activities affected livelihood assets of cultural identity like land rights reserved for future use. Mining also led to increased insecurity such as loss of livestock herds because of reduced grazing lands occupied by mining activities (Bebbington & Bury, 2009). Mining has led to the displacement of local people from their ancestral lands resulting in marginalization and oppression of lower-income classes of people (Kitula, 2006).

According to IFAD (2001), about 70% of populations in Africa depend directly on environmental resources, which are land for their livelihoods. In the past, however, local people lived on livestock and crop farming (Kitula, 2006). With the diversified population in the study area, other skills were introduced including mining, which was not the major economic activity to the people of Kamtonga and Mkuki. Hence mining became an additional source of income by creating income opportunities for local farmers who obtained a closer market for their products (Kitula, 2006).

Currently, people in Kamtonga and Mkuki are mainly involved in farming and trading. The presence of mining activities created market opportunities for local farmers because of the increased demand for food by miners. During this study, the area had received a lot of rain and the Kenya Wildlife Service had just constructed an electric fence around these farms so that elephants were not able to invade their farms. The study revealed that as a result of the electric fence, residents in those mining areas harvested a lot of food and were able to sell their

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produce, at the developed market centres, and increase their income. According to one of the key informants, this was a windfall for people who had suffered for a long time from wild animals invading the farms. Some findings showed that some made reasonable earnings in good months while some still lived from hand to mouth. From the study done by Makindi *et al*. (2014) most of the countries in Africa such as Kenya, 70% of the wildlife live outside protected areas and when humans encroach their habitat, human-wildlife conflict results. Because of new opportunities occasioned by mining, some people abandoned farming for the business thus enhancing community wellbeing.

This study revealed that households that engaged in mining and food vending seemed to have benefitted the most because they combined selling of food to the miners with farming. This study is supported by that of Aragon & Rud (2015) who explained that local communities and especially women around the mining areas abandoned farming activities and moved to business occupation around the mining places. Many households had at least one member of the family actively engaged in mining, hence alleviating poverty which is the first goal in Sustainable Development goals (SDGs) (Assembly, 2015).

Many respondents agreed that mining had greatly improved infrastructure in the form of roads, schools, health centres and market centres. This was probably due to the increase in income levels as well as the living standards of the community around the area. Aragon & Rud (2015) noted a positive effect of mine operations on access to better and improved health care due to an increased number of health centres in areas nearing the mining areas. For example in Mali, mining increased the length of good roads and numbers of health centres.

Respondents admitted that mining enabled improved housing quality. An increased share of household expenditure on housing and energy has been contributed greatly by increased mining activities in the areas, as wages for those working in mining are higher than average for the same population.

Some respondents lost their land to mining. The loss of lands was due to an increased number and size of mining pits and especially in the areas that were poorly rehabilitated. As observed by Ayensu-Ntim *et al*. (2015) impacts of mining included losing agricultural land to large-scale mining, resulting in reduced crop yields and increased poverty. On the other hand, according to Crowson (2011), mining has multiple effects on development, since it creates job opportunities both directly and indirectly (Crowson, 2011; Malagon, 2012) increasing purchasing power, although some respondents disputed the fact that, through mining activities, they had bought land, houses, cars and their livestock. Some, though, consented that mining activities helped them buy other livelihood items like farming tools and working tools.

Respondents contended that mining companies did not share their accrued revenues or support development projects as expected. This challenge for mining development has been documented elsewhere, as equitable distribution of mineral resource revenues to all stakeholders is a difficult thing for extractive industries (Shoko & Mwitwa, 2015). Impartial benefits distribution is related to fairness or justness especially in the distribution of mineral resources as well as the costs in accordance to the various sector's needs, aligning with Brundtland Commission, which explains the concept of sustainable development (Jabareen, 2008). To reduce poverty, equitable distribution of benefits and costs need to be considered as essential.

The findings of this study show that mining improved the livelihoods of communities through employment at the mines, accessing healthcare, education and the skill transfer as well as better housing. Farming and business remained a major socio-economic activity in the area.

Mining activities should be conducted in a way which is perceived as fair by the present and future generation while eliminating poverty and enhancing the economic development of mining areas (Esteves, 2008). Because there exists inequality in consumption and distribution of mined minerals, for instance in Peru where mining intensified in the 2000s, it was realized that mining locations had higher benefits than those which are not mining thus contributing to poverty in such regions (Loayza & Rigolini, 2016). Thus governments need to balance the needs of local communities with the creation of a conducive environment that attracts investors and demonstrates mineral potential and viability for mineral extraction as done in Zambia (IIED, 2002).

5.6 Conclusion

In conclusion, this study about the impact of mining on communities' livelihoods in the selected areas of Kamtonga and Mkuki has shown that:

The mining sector has attracted people from different counties into Taita Taveta County. Diverse economic activities have grown as a result of the mining industry in the area. Both genders are equally engaged in agriculture and diversification of economic activities for their household sustainability. Most men work mainly in the mining sector and have had greater economic and financial gains than women. Respondents agreed that mining activities assisted in the creation of new business opportunities such as food vending, done mainly by women, improved transportation, food security and wealth creation. Every household has at least one family member actively working in the mining operations and this has been a great

contribution to poverty alleviation within the household. Mining operation within the study area has brought about improvements in infrastructure such as roads, schools, health and market centre as well as improved quality of houses. Mining helped some communities to purchase livelihood items such as farming and working tools. There are nonetheless some negative outcomes owing to the mining operations which have affected the communities within the study areas of Kamtonga and Mkuki. For some of the households, mining did not help them in the acquisition of properties like land, cars and houses. This meant that even though mining enhanced ability to meet their day to day needs, it fell short of creating wealth in form of assets. Some communities lost their land due to increased number and sizes of mining pits, especially where the same were poorly rehabilitated. Open mining pits and large-scale mining have caused a loss of agricultural land resulting in reduced crop yields and poor living standards. On the issue of compensation, some established mining companies in the area did not share their accrued revenues nor did they support development projects as was expected. Also, lack of proper mining regulations has rendered the indigenes powerless when migrants invade their land for mining.

CHAPTER SIX: IMPACT OF MINING ON ENVIRONMENT: A CASE STUDY OF TAITA TAVETA COUNTY

ABSTRACT

Mining is an excavation process that clears vegetation for access roads and processing. It usually causes potential environmental impacts at all stages including air pollution, topographical and vegetation impacts. The study looked at the impact of the environment using three parameters of vegetation, topography and air quality, on nine selected mining sites in Kamtonga and Mkuki, Taita Taveta County. The results showed loss of indigenous-trees, shrubs, grassland, forests and most of the other natural ecosystems cleared to pave way for mining activities. The study revealed that human beings, domestic and wild animal and natural history, were affected by abandoned pits that imperilled the areas surrounded by mining sites. In a scale of 1-5 (1=None, 2=Very thin, 3=Thin, 4=Thick, 5=Very thick) it was observed that transportation of materials created thick dust on the environment as given in a scale of 4. Exhaust and gas emissions also polluted the air. Dust, noise and earth vibrations were observed to occur, especially during blasting. It is suggested that the government should implement mining regulations that will secure wildlife and their habitat during mining and enforce subsequent restoration of the excavated areas to original status. Environmental Social and Impact Assessment and Environmental Audit should be conducted as per the mining regulation in Environmental Management and Coordination act 1999(amended 2019) in Kenya.

Keywords: Environment, Mining impacts, Observation, Pits, Sustainable, Waste Piles

6.1 Introduction

Mining is an economic process that begins with exploration for and discovery of mineral deposits and continues through extraction and processing to closure and remediation of exploitation sites (Gosar, 2004; Hoskin *et al*., 2000). Different forms of mining methods are used depending on the type of mine being extracted. These methods have varying impacts on the environment. Therefore, a working definition of mining could simply be "the extraction of minerals from the Earth". On the one hand, mining generates wealth for companies, communities and countries. Metals and other mined materials are an integral part of human life on this planet. Mining has sociological impacts which include generating huge amounts of waste and pollution, disrupting indigenous livelihood, local economies and communities, destroying natural habitat and maybe leaving toxic legacy-acid mine drainage (AMD). Some negative environmental impacts may persist for hundreds of years (Gosar, 2004).

In many developing countries, unregistered and illegal small-scale mining is widespread (Bush, 2009; Hilson, 2009) leading to environmental deterioration. Mining has adverse impacts on societies and their cultural heritage. Other impacts concern health and safety of mineworkers and communities close to operations, including displacement marginalization, and oppression of local people. Further, mining environmental impacts include erosion, the formation of sinkholes, and loss of biodiversity, soil and water chemical contamination. It may further cause noise, dust and visual pollution (Cuba *et al., 2014*). A variety of minerals found in Kenyan coastal strip include industrial minerals ranging from talc and gypsum dolomite and gemstones. Other minerals are gold, silver, copper, zinc, and titanium (Abuodha, 2002). Their extraction has negative consequences in the area despite playing a pivotal role in job creation and poverty alleviation (Davies & Osono, 2005; Kröner, 2003).

Environmental impacts of mining are classified into physical, pollution and occupational health impacts. The direct observable effects of small-scale mining in Taita Taveta County have not been well documented. The physical effects on the environment such as air, land and water; due to mining activities have also not been detailed. Yet they discomfort the people living adjacent to or working in the mines (Davie and Osano, 2005). The results presented in this paper arose from direct observation of the environmental impacts of mining on topography, air and vegetation in Taita Taveta County (Binnendijk, 2006).

6.2 Materials and Methods

6.2.1 Study Area

This study was done in Taita Taveta County, located in the Coastal region of Kenya. The observations were made in Mwatate sub-county's minefields of Kamtonga, and Mkuki, about the geographical coordinates of $3^030'0"$ S, $38^023'0"$ E. These minefields were purposively selected as representative samples of the mining industry in Taita Taveta because they were easily accessible, unlike those of Kasigau in Tsavo West. The county is divided into three major topographical zones. The upper zone, suitable for horticultural farming comprises of Taita, Mwambirwa and Sagalla hills region with altitudes ranging between 304 meters and 2,208 meters above sea level. Mining takes place in the lower zones consisting of plains, where ranches and national game parks are placed.
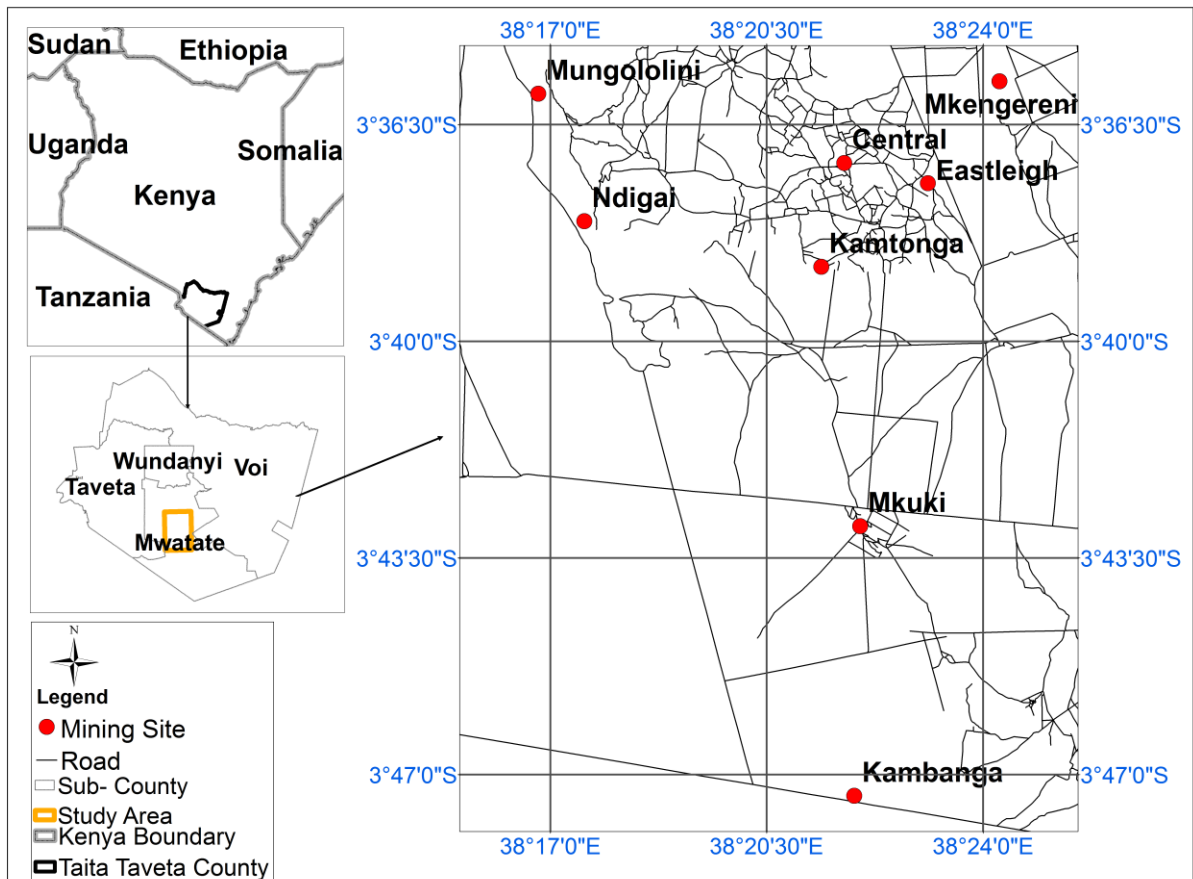
Figure 2: Map of the Mining Areas

6.2.2 The Geology of the study area

The Taita mining operations are in Taita Hills, Mwatate, Kasigau and Kuranze areas. The Taita region is covered by the Mozambique belt, while the Taveta region is covered by the Tertiary Volcanic belt. The complex rocks of this belt underlie most of the Eastern African region between Ethiopia to the North and Mozambique to the South. The County is the main source of Tsavorite and ruby minerals worldwide.

6.3 Population

6.3.1 Population and Activities

The population of Taita Taveta County is 340,671 (KNBS, 2019) having grown from 284,657 in 2009. Mwatate Sub County population has an estimate of 1.95 per cent of the county

population which has grown to 81659 people (KNBS, 2019) partly because of people migrating to town to establish businesses especially trading in precious stone called Tsavorite, found plentifully around Mkuki and Kamtonga areas.

6.3.2 Sampling

Purposive sampling method was used to select mining sites. These included nine mines comprising of large, semi and fully mechanized mining groups, Small artisanal mining groups and individuals doing manual mining and surface mining in Kamtonga and Mkuki areas of Mwatate sub-county. The researcher conducted the observational research in a real-life situation which yielded valuable insights on the issues of vegetation, topography and air around the mining sites.

6.3.3 Research approaches

The study used a structured observation approach on the state of three environmental elements namely vegetation, topography and air in nine mining sites in Kamtonga and Mkuki area of Taita Taveta County in Kenya. These purposively selected mines included; Shah mines, Ray mines, Shadrack (individual digger), International Mines, Mama Fatuma mines, Surface mining (group), Hardrock mines, Chawia Mining Community Based Organization (CBO) and Classic 1 Gemstone Mines. The elements of the environment chosen for observation were topography, air, and vegetation around the selected mining areas. The focus was mainly on mining approaches, their characteristics and proximity to the urban infrastructure and neighbouring communities.

6.3.4 Data collection and analysis

Structured Record sheets formed the data collection tool in all the nine selected mining sites. The record sheets were used to record the observations made on different aspects that concern impacts of mining on vegetation, topography and air. Data collected comprised of the type of mining, mining approaches and characteristics. Statistical Package for Social Sciences (SPSS) was used or analysis of the data which is presented by means.

6.4 Results and Discussion

6.4.1 Mining Approaches and Characteristics

Popular mining approaches used included excavation and removal of overburden (layers) in underground and open pit/surface mining. The mining activities revealed characteristics such as pits below groundwater level, deep in the ground, horizontal tunnels shafts and strip mining (Figure 3, 4, 5, 6; Table 6.1). Wherever these mining activities were conducted they resulted in deforestation and great damage around the pits such as soil, vegetation, and grassland damage hence altering the topography of the area.

Figure 3: Open Pit

Figure 4: Horizontal tunnels and Shafts

Figure 5: Strip Mining

Figure 6: Deep in the ground

Table 6.1: Types of mining approaches, techniques and characteristics

Mine characteristics	Mining Type (Number of mines observed)			Total
	Mechanized	Surface Mining	Open Pit	
Pits below groundwater level	4	0	1	5
Horizontal tunnels and shafts	0	0	1	1
Strip mining	0	1	0	1
Deep in the ground	0	0	2	2
Total	**4**	**1**	**4**	**9**

6.4.2   Mining Operations Proximity to Urban Infrastructure

Mining operations proximity to urban infrastructure was measured in Kilometers and it emerged that most livelihood centres were quite far from the mining areas and its communities. At the mining site, there was no water reticulation system. Therefore, water has to be bought and delivered to those in the mining fields. The residential areas, to the mining sites, are about

20-40 km while the water sources ranged between 40-42 kilometres. The distance from various mines in Kamtonga and Mkuki to the main shopping centres in Mwatate and Voi is 20-40km. There is a lot of activity in Mkuki and growth of the shopping Centre due to mining activities attracting selling and buying of the valuable gemstones. Churches in the area are located 2-3 km from mining areas (Table 6.2).

Table 6.2: Mining Operations Proximity to Urban Infrastructure

	Mining Type Proximity, (Km)			
Distance	**Mechanized**	**Surface Mining**	**Open Pit**	**Total**
Between residential area and mine (Km)	31.0	21.0	30.5	29.7
Between water sources and mines (Km)	30.8	1.0	20.5	22.9
Between shopping centres and mines (Km)	21.3	21.0	30.5	25.3

6.4.3 Mining Activity Influence on Topography

Mining activity influence on topography was observed on all the nine mine sites on a scale of 1-5 (none, damaged, moderately damaged, highly damaged and extensively damaged). Observation focused on valleys, plains, damp sites/piles, natural water head, hills and wetlands. Around all the mines there were no valleys, plains, hills and wetlands (Table 6.3). Dump piles were an eyesore in most of the mines. Most of the mining sites observed had dump piles causing moderate damage while others had highly damaged the areas especially surface mining which caused extensive damages (Figure 7, 8, 9, 10).

Table 6.3: Subjective assessment of the type of mining activity influence on topography

	Mining approach			
Topography	**Mechanized**	**Surface Mining**	**Open Pit**	**Total**
Valleys	1.0	1.0	1.0	1.0
Plains	1.2	1.0	1.5	1.4
Dump piles	2.4	3.0	2.6	2.6
Natural Water Heads	1.1	1.0	1.0	1.1
Hills	1.0	1.0	1.0	1.0
Wetlands	1.0	1.0	1.0	1.0

Scale of 1-5 (1=none, 2=damaged, 3=moderately damaged, 4=Highly damaged, 5=Extensively damaged)

Figure 7: Dump piles

Figure 8: Abandoned mining Trenches

Figure 9: Damaged Vegetation cover

Figure 10: Abandoned Mining Pits

Mining activities generate unique effects on landforms, shapes, structure and stream headwaters (Lechner *et al*., 2016, Ross *et al.,* 2016). Only hydro-seeded grass and non-native tree species are found on the alkaline soils of reclaimed mining areas. Native plants do not grow again once removed for mining operations.

6.4.4 Mining Activity influence on vegetation

In this study, the mining activity influence on vegetation was also observed. Aspects of vegetation observed included general categories of trees, shrubs and grass. Also, animal life around the mining area was observed. Observation from all the nine mining sites revealed

similar characteristics where trees, shrubs and grass were sparsely populated (Table 6.4; Figure 6.2). In surface and open pits mining, there was no grass as the method involves removal of the topsoil that is fertile and supports the growth of land cover. The animal life was distributed all over the mining areas, located in variously owned ranches, but with moderate to dense distribution in some mining sites.

Table 6.4: Mining Activity influence on vegetation within proximity of mines between 0-1kilometre

Vegetation	Mechanized	Surface Mining	Open Pit	Total
Trees	2	2.5	2.6	2.3
Shrubs	2.5	2.5	2.3	2.4
Grass	3	1	1.8	2.2
Animal life	3.7	3.5	3.5	3.6

(Scale 1-5)1=none (ground is bare) 2=sparse 3=moderate and lush 4= dense and lush 5= very dense and green

The natural habitation and indigenous trees have been cleared. Mining activities have impacts on vegetation that includes; deforestation, destruction of habitats, soil erosion, disruption of watersheds and pollution. The tendency of clearing the vegetation was to prepare trenches and pits to remove the minerals. Adejei (2007) also observed similar mining destruction of reserves upon which thousands of people depended for their food and livelihoods. Ogola *et al.* (2002) explained gold mining resulted in increased removal of vegetation in Migori County.

Global Forests Atlas (GFA) and World Wide Fund for Nature (WWF) reports state that mining is the cause for 7% of the deforestation in sub-tropics including 6,100 sq. kilometres of Amazon forests. It is recorded that as Ghana got its independence, its forest estate was 8.3 million hectares, but mining activities reduced the cover to only 1.2 million hectares (Hilson, 2004).

According to Ross *et al.* (2016), it is revealed that mining affects environmental systems including water quantity and quality degradation and burying of streams headwater. After removal of vegetation, the bare ground remaining loses water through evaporation. Besides, destruction of natural land topography and landscapes, negatively affect water movement thus leading to either diversion or disappearing of such streams in the areas (Lechner *et al*., 2016).

6.4.5 Mining effects on Air

Another aspect observed in this study was the mining effects on air. The study focussed on the levels of noise and dust as a result of blasting, transportation, tailing (mine dump) stockpiles, haul roads, exhaust emissions (car trucks, heavy equipment) and Gas emissions (Table 6.5). At the time of collecting this data most of the listed activities were sporadically performed. This posed as a limitation to the researcher regarding the consistency of the questionnaire. For example, some mining sites did their blasting at night or early hours while some did it in the afternoons.

The dust from the blasting, transportation of materials, Exhaust Emissions (Cars, trucks, and heavy equipment) and gas emissions in surface mining was very thick, because of open mining methods used, and wind. The blasting was mainly done at 11 a.m and 6 p.m in some mines while the transportation of materials time was between 2-3 p.m. Gas emissions from trucks and heavy types of equipment like generators were unnoticeable during blasting where the mines were fully or semi-mechanized. Both dust and noise also depended on the horizontal tunnels shafts of the mining pits which stretched to between 200-400 meters long. Increased activities such as surface and underground mining have led to increased dust production. The busy and speedy traffic in and out of the mining areas for mineral trading also resulted in a lot of dust.

According to Ogola *et al.* (2002) soils left unprotected during the removal of vegetation led to the production of intensive dust and wind erosion.

Table 6.5: Effects of mining on Air

Activities	Mechanized	Surface Mining	Open Pit	Total
Blasting	2.0	5.0	2.7	2.6
Transportation of materials	3.5	5.0	4.3	4.0
Wind erosion	3.3	4.0	3.0	3.3
Fugitive dust from tailings facilities	2.0	2.0	3.7	2.6
Stockpiles	1.0	2.0	1.3	1.3
Waste dumps	2.8	4.0	3.7	3.3
Haul roads	2.8	3.0	3.7	3.1
Exhaust Emissions (Cars, trucks, heavy equipment)	3.8	5.0	3.7	3.9
Gas Emissions	2.8	5.0	2.5	3.4

Scale 1-5 (1=none 2=Very thin 3= Thin 4=Thick 5= Very thick)

Air is polluted during mining activities during excavation because small particles are easily dispersed by the wind (Fugiel *et al*., 2017). The quality of the air is reduced, resulting in poor human health, and diminished vegetation close to the mining areas (Ghorani-Azam *et al.* 2016). Fine and coarse particulate matter can reach the lungs leading to respiratory problems. Heavy dust plume production also affects visibility and the chemicals, from dust, released into the atmosphere also kill Flora and Fauna and also pollute the air, water and land.

6.4.6 Mining activity influence on noise and earth vibrations

Noise and earth vibrations were produced during excavation activities. Vibrations are associated with many types of equipment used in mining operations, but blasting is considered a major source of the more disturbing noise and vibration. Vibrations affect the stability of infrastructures and homes of people living near mining operations. Most of the noise is caused

by loading and unloading of rocks, power generations, shovelling, drilling, blasting, transport, and stockpiling caused most noise (Table 6.6). Only four of the mining sites had powered tractors and power generators. In surface mining, drilling, blasting and transportation process was very loud. None of the mining sites owned a steel dumper or carried out such activities as chutting, ripping, and crash grinding. Nevertheless, there was no control of noise and vibration effects, which could negatively affect the workers in the mining sector.

Table 6.6: Effects of Mining activities on noise

Activities	Mechanized	Surface Mining	Open Pit	Total
Transport	2.0	4.0	3.0	2.7
Vehicle engines	2.0	3.0	2.8	2.4
Drilling	1.8	4.0	2.8	2.4
Blasting	2.3	4.0	1.8	2.2
Ripping	2.0	1.0	2.0	1.9
Power generations	1.3	3.0	2.3	1.9
Stock pilling	1.3	1.0	1.5	1.3
Shovelling earth	1.3	1.0	1.3	1.2
Loading and unloading into steel dumpers	1.0	1.0	1.0	1.0
Chutes	1.0	1.0	1.0	1.0
Crash grinding	1.0	1.0	1.0	1.0

Scale 1-5 (1=none 2=minimum 3=moderate 4=loud 5=very loud)

Table 6.7: Effects of Mining activities on Earth Vibrations

Activities	Mechanized	Surface Mining	Open Pit	Total
Drilling earth	4	4	3.5	3.8
Power generation earth	2	3	2.5	2.3
Blasting earth	1.5	4	1.8	1.9
Transport earth	1.8	2	2	1.9
Vehicle engines earth	1	1	1	1
Loading and unloading into steel dumpers earth	1	1	1	1
Chutes earth	1	1	1	1
Shovelling earth	1	1	1	1
Crash grinding earth	1	1	1	1
Stockpiling Earth	1	1	1	1

Scale 1-4 (1=none 2=minimum 3=moderate 4=very loud)

The effects of noise and vibrations can directly affect the health of the miners and their neighbours. Even so, miners observed were not protected against these mining hazards. There was a display of ignorance and negligence concerning the use of protective gears. It could also be due to inadequate law enforcement by government agencies. Section 101 of No 8 of Environmental Management and Co-ordination Act I999 (amended 2016) recommends minimum standards for emissions of noise and vibration pollution into the environment are necessary to preserve and maintain public health and the environment (EMCA, 2016).

A study by Chen *et al*. (2018) on coal and gas outburst hazards in Henan, China, revealed that lack of knowledge among people working in coal mining areas was blamed for their failure to use protective gear, which exposed them to injuries on heads, legs, hands and backs. Ignorance has led most miners to expose themselves to danger, sometimes even to the extent of losing their lives due to lack of protective gears (Friend & Kohn, 2018). Then there is an element of

risk to nature, especially to wildlife. Therefore, environment and wildlife safeguard agencies, have an urgent need to be more proactive in policy and law formulation and also in their enforcement. Reluctance on the part of the authoritative governmental body has resulted in lack of their visibility. The two sectors can play a very important role in ensuring that forests do not critically face adverse impacts during mining. Also, enforcement of environmental impact assessment requirements is critical in predicting and planning for mitigation of impacts likely to emerge due to mining. This study goes hand in hand with that of Mwangi & Mutiso (2018) who explains that there is need to develop a complete regulation in the forest and environment department to increase sufficient capacity for monitoring and enforcing various laws and regulations to ensure forests and the whole environment is well managed.

6.5 Conclusion

The study results revealed that clearing of trees, shrubs and grassland during mining preparations destroyed the top fertile soil. Forests and most of the natural habitation and indigenous trees were eliminated. There was a loss of plant biodiversity directly affecting domestic and wild animals. Little administrative and legal sanction has been instituted to contain the pollution, despite uncontrolled dust in the air and the fact that miners are not protected against mining hazards.

6.6 Recommendations

1. There should be joint efforts between miners and concerned government instruments to oversee the rehabilitation and restoration of areas degraded by mining, by making sure the pits are filled up, soil piles are removed, and Re-afforestation and waterways sources are restored.

2. Clearing of vegetation and forests should be guided by some regulations jointly prepared by ministries of environment, water, and health. The regulations should institutionalize Environmental Impact Assessments for all mining licensing.

3. Engage community participation in mining, water and forest management to ensure sustainable environmental protection

CHAPTER SEVEN: GENERAL DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

7.1 General Discussion

Mining is a major economic activity in Taita Taveta County. Whether the operations are large or small scale, mining has a potentially positive and negative influence on local communities in general. They include employment, income and community development as positive and the displacement of the same communities from their homes and land as challenges (Hilson, & McQuilken,2014).

Mining impacts on the social-cultural aspects considered the gender aspects of the communities in Kamtonga and Mkuki. The study revealed that mining-affected education progress of females. Male respondents had secondary level education while most girls would not enrol into secondary schools. School dropout rates were high as most girls engaged in food vending to miners, or due to pregnancies and prostitution. Culture and traditional activities, land ownership, community and social behaviour, religion and morality, which were strongly upheld before mining started, were diluted as migrants from other counties invaded the mining area making it a diaspora of some sort. Insecurity has become a factor in the mining areas. According to one key informant, "an increased immigrant has brought about insecurity in the areas with increased reported cases of theft within the mining centres. There is mistrust within the families as miners get a lot of money which does not go down to families". Mining has created job opportunities for the inhabitants of Kamtonga and Mkuki and with it, escalation of drugs and alcohol abuse and polygamous lifestyles (Table 4.5). The influence to the communities in these areas has been both positive and negative in that while there has been exposure mingling with people from other counties, and while mining brought in jobs, immoral

values also were introduced. Some respondents lost their land, school dropout, especially on girls escalated due to mining activities.

The study also revealed that on the whole, mining had also impacted the livelihood of the communities in Kamtonga and Mkuki positively and negatively. On the advent of mining, women who customarily would wait for their men to provide got involved in various forms of business activities. They were also doing farming and some did mining (Table 5.7). Business here included shopkeeping, poultry, livestock, food vending among others. These enabled them to support their households. Men were engaged in mining as well as farming an indication that they did not make enough income from working in the mining sites. It is however obvious that mining has contributed to economic and financial gains to some farmers. The study also revealed that as much as mining activities assisted in the creation of business opportunities, it did not help in the acquisition of land, cars or houses. This means that mining enabled the communities of Kamtonga and Mkuki to enhance the ability to meet day to day needs but fell short of creating wealth in the form of assets that generate income to the people.

Mining operations have affected environmental aspects of the area in various ways including change in topography, deforestation, shrubs and grassland degradation, soil damage to pave way for mining activities (Kitula, 2006). Native plants have disappeared and cannot grow again due to thin alkaline soils of reclaimed mines, resulting in sparse vegetation with abandoned open pits, posing as a danger to human and animal life. Similar observations on biodiversity were made in Tanzania (Kitula, 2006). In Kamtonga and Mkuki the study concentrated on three environmental aspects impacted by mining. These were topography, vegetation and air. The study revealed that there was a negative impact on all the three areas on the communities living in these areas. The damage on the topography was evident especially for areas close to

mining sites. Dump piles littered the areas meaning no agricultural activity would be viable in the affected areas. Mining activities interfered with the forest cover, which resulted in the drying up of water beds and rivers. This has caused the communities to source their water from as far as 31Km (Table 6.2) away from their residences. On vegetation, Kamtonga and Mkuki are characterised with sparsely populated trees, shrubs and grass because natural habitation and indigenous trees are cleared for mining activities. Observation revealed that effects on vegetation extended to the proximity of 1 km from the mining sites. However, even with moderate to the dense distribution of vegetation, animal life is threatened in the ranches within Kamtonga and Mkuki areas (Figure 6.2). Communities are left vulnerable while they still do some farming of basic foodstuffs like maize, pigeon peas and cassava and can gather firewood. Blasting, transportation, mine dumping, earth vibrations, exhaust and gas emissions caused air pollution. Both surface and underground mining resulted in increased dust production which when dispersed by the wind would impact communities and also flora and fauna in the area (Table 6.4). This picture is also described by (Pegg, 2006) who reported that in Zambia and DR Congo, the annual high emission, by copper smelters, of Sulphur dioxide contributed to soil contamination and loss of vegetation. On the other hand (Mwitwa *et al*., 2012) also stated that the environmental impacts of mining projects make the poor very vulnerable. They lose forests from deforestation, and timber consumption. They also lose their land while air is polluted (from dumpsites) noise, and earth vibration from machinery and blasting.

A close examination of the discussion above shows that the three mining aspects have interrelated effects and influences, caused by mining on Kamtonga and Mkuki people. Mining has influenced and impacted the communities positively and negatively. The findings in the study indicate that mining improved the well-being of communities through employment, accessing healthcare, education, better housing (Figure 7.1) below.
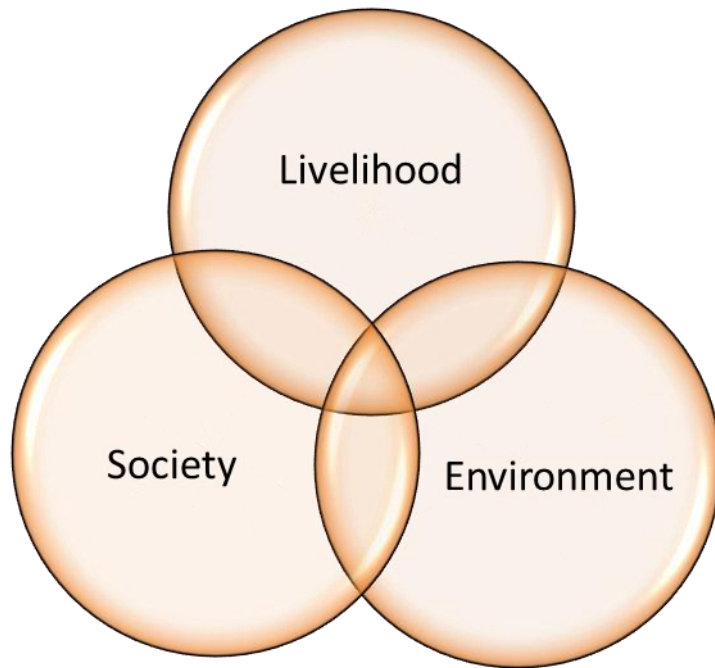
Figure 7.1: Relationship between Society, Livelihoods and environment

Mining activities have led to a rise in diverse economic activities and the income derived from them supports livelihoods. On the other hand, mining may not be the primary or key economic occupation for most of the local people in the region but it still provides essential supplementary income (Kitula, 2006). However, the gains from mining were unevenly distributed to respondents and thus to members of the communities. Where gains were realized, evidence of acquisition of properties like land, cars and houses should have been observed. But this study found out that mining did not help respondents to acquire such properties and assets. It appears that households that engaged in mining and food vending benefitted the most from these combined activities in addition to farming. During the advent of mining and in its development, infrastructural improvement including roads, schools, a health and market centre was the result. The stated gains contrasted with those observed in Ghana where mining operations had a negative outcome to the livelihoods of some of the rural households (Adjei, 2007).

In Taita, however, mining enhanced ability to meet day to day needs for the communities without making a significant proportion of residents wealthy. Mining caused the migration of people from other counties in and outside Kenya. The resultant mixed communities led to a dilution of cultural and traditional concepts values and practices of indigenous people. The advent of mining, in the 1960s, and probably because of external influence and increasing affluence, family unity disintegrated and family members dispersed to new areas away from their home villages. This disrupted family life and reduced cohesion. Horsley *et al*. (2015) documented that mining impacts the economic and social fabric of the local community. The mixture of residents and newcomers, employment and rise in incomes in some cases increased alcoholism, prostitution and child labour. The culture evolution could be directly connected to relocation and disconnect resulting in loss of strong socio-cultural ties and identity (Horsley, *et al*. (2015). Sacred places, rites and practices may be lost resulting in mixed intermarriages, serious spiritual and cultural practices variation. The net effect would be devalued moral values, conflicts, increased prostitution, alcoholism and high school dropouts.

The monthly earnings caused disparity in society. The high demands of gemstones caused increased cases of land conflicts and led to some loss of land. Open mining pits and large-scale mining took over agricultural land. The poor sold the land and became even more impoverished while attempting to attain equal social standing.

7.2 Conclusion

This study shows that mining improved the livelihoods of communities living around the mining areas of Kamtonga and Mkuki due to the diverse economic activities introduced in the area. Driven by ambition, people from different counties have been attracted to Taita. The locals make more money than non-locals and only one businessman from Makueni makes

more. Culture change, land conflicts, alcoholism, drug addiction, school drop-outs and prostitution in the mining areas have been on the rise. Clearing of trees, shrubs and grassland to pave way for mining activities caused loss in biodiversity and wildlife and minimal rehabilitation has taken place. Even though livelihood costs were eased, poverty prevails in these areas as the communities still depend heavily on farming.

7.3 Recommendations

From my study on Society, Livelihood and Environmental, the sustainability of people living in the mining areas, I recommend that:

1. The County Government should enforce efforts to popularize modern mining methods to mitigate the negative environmental effects that mining generates. Short training sessions for minor and mining groups should be organized.

2. The trading of minerals and gemstones need to be better organized to ensure fairness of compensation from mining.

3. Finally, the researcher recommends further study on the impacts of mining on health and education of people living in mining areas.

REFERENCES

Abuodha, J. O. Z. (2002). Environmental impact assessment of the proposed titanium mining project in Kwale District, Kenya. *Marine Georesources and Geotechnology, 20, 199-207.*

Act, M. (2016). No. 12 of 2016. Laws of Kenya *(Government Printer, Nairobi).*

Adeola, F. O. (2001). Environmental injustice and human rights abuse: the states, MNCs, and repression of minority groups in the world system. *Human Ecology Review*, *39-59.*

Adjei, E. (2007). Impact of mining on livelihoods of rural households. A case study of farmers in the Wassa Mining Region, Ghana *(Master's thesis, Geografisk institutt).*

Akabzaa, T., & Darimani, A. (2001). Impact of mining sector investment in Ghana: A study of the Tarkwa mining region. *Third World Network*, *47-61*.

Amina, J. A. (2015). Challenges Faced by Girls who Dropout from Senior High School: the Voices of Sixty Dropout Girls in the Upper West Region of Ghana. *International Journal of Humanities and Social Science*, *5(6 (1)).*

Amutabi, M., & Lutta-Mukhebi, M. (2001). Gender and Mining in Kenya: The case of Mukibira mines in Vihiga District. *Jenda: a journal of culture and African women studies*, *1(2).*

Anyona, S., & Rop, B. (2015, May, a). Environmental Impacts of Artisanal and Small-scale Mining in Taita Taveta County. In *Proceedings of Sustainable Research and Innovation Conference (pp. 228-241).*

Anyona, S., & Rop, B. (2015, May, b). The Proposed Gemstone Centre and its Likely Impacts on Small Scale Mining Industry in Taita Taveta County. In *Proceedings of Sustainable Research and Innovation Conference (pp. 98-108).*

Apollo, F., Ndinya, A., Ogada, M., & Rop, B. (2017). Feasibility and acceptability of environmental management strategies among artisan miners in Taita Taveta County, Kenya. *Journal of Sustainable Mining*, *16*(4), *189-195.*

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Appiah, D. O., & Buaben, J. N. (2012). Is gold mining a bane or a blessing in Sub-Saharan Africa: the case of Ghana. *International Journal of Development and Sustainability*, *1*(3), *1033*-1048.

Aragón, F. M., & Rud, J. P. (2013). Natural resources and local communities: evidence from a Peruvian gold mine. *American Economic Journal: Economic Policy*, 5(2), 1-25.

Aragón, F. M., Chuhan-Pole, P., & Land, B. C. (2015). The local economic impacts of resource abundance: What have we learned? *The World Bank.* *https://openknowledge.worldbank.org/handle/10986/21995*

Aragón, F. M., Rud, J. P., & Toews, G. (2015). Mining Closure, Gender and Employment Reallocations: in the case of UK coal mines. *Oxford Centre for the Analysis of Resource Rich Economies, University of Oxford, OxCarre Working Papers 161.*

Assembly, G. E. N. E. R. A. L. (2015). Sustainable development goals. (SDGs), Transforming our world: the, 2030. *United Nations: New York, NY, USA.*

Ayensu-Ntim, A., Doso Jr, S., & Twumasi-Ankrah, B. (2015). Effects of loss of agricultural land due to large-scale gold mining on agriculture in Ghana: the case of the Western Region. *Br J Res [Internet]*, *2(6), 196-221.*

Azapagic, A. (2004). Developing a framework for sustainable development indicators for the mining and minerals industry. *Journal of cleaner production*, 12(6), 639-662.

Baru, J. K., & Moronge, M. (2018). Factors influencing the performance of artisanal and small scale mining projects in Taita Taveta County, Kenya.

Bebbington, A. J., & Bury, J. T. (2009). Institutional challenges for mining and sustainability in Peru. *Proceedings of the National Academy of Sciences*, *106(41), 17296-17301.*

Behnke, C., & Meuser, M. (2012). " Look here, mate! Im taking parental leave for a year". involved Fatherhood and images of masculinity. *Fatherhood in Late Modernity: Cultural Images, Social Practices, Structural Frames, Budrich, Barbara, Leverkusen*, *129-145.*

Bell, F. G., Stacey, T. R., & Genske, D. D. (2000). Mining subsidence and its effect on the environment: some differing examples. *Environmental Geology*, *40(1-2), 135-152.*

Bharali, G. (2007, March). Development-induced displacement: A history of transition to impoverishment and environmental degradation. In *Seminar on Ecology, Department of History, Dibrugarh University, March (pp. 27-28)*.

Binnendijk, A. (2006). Performance Monitoring and Evaluation Tips. *Retrieved from USAID*.

Boadi, S., Nsor, C. A., Antobre, O. O., & Acquah, E. (2016). An analysis of illegal mining on the Offin shelterbelt forest reserve, Ghana: Implications on community livelihood. *Journal of Sustainable Mining*, *15(3), 115-119.*

Booth, W. C., Booth, W. C., Colomb, G. G., Colomb, G. G., Williams, J. M., & Williams, J. M. (2003). *The craft of research. University of Chicago Press.*

Buckley, T. (2019). Over 100 Global Financial Institutions are exiting coal, with more to come. *Institute for Energy Economics and Financial Analysis*.

Bush, R. (2009). 'Soon there will be no-one left to take the corpses to the morgue': accumulation and abjection in Ghana's mining communities. *Resources Policy*, *34(1-2), 57-63.*

Caballero, E. J. (2017). Traditional small scale miners: Women miners of the Philippines. *Women Miners in Developing Countries (pp. 145-162). Routledge.*

Chambers, R., & Conway, G. (1992). Sustainable rural livelihoods: practical concepts for the 21st century. *IDS discussion paper, No. 296. pp.127-130.*

Chen, L., Wang, E., Ou, J., & Fu, J. (2018). Coal and gas outburst hazards and factors of the No. B-1 Coalbed, Henan, China. *Geosciences Journal, 22(1), 171-182.*

Machakos County (2015). Integrated Development Plan. *Machakos County, Kenya. Available from:< http://www. machakosgovernment. com/>,[Accessed 18th August 2015]*.

Crowson, P. C. F. (2011). Mineral reserves and future minerals availability. *Mineral Economics*, *24(1), 1-6.*

Cuba, N., Bebbington, A., Rogan, J., & Millones, M. (2014). Extractive industries, livelihoods and natural resource competition: Mapping overlapping claims in Peru and Ghana. *Applied Geography*, *54, 250-261.*

Darimani, A., Akabzaa, T. M. & Attuquayefio, D. K. (2013). Effective environmental governance and outcomes for gold mining in Obuasi and Birim North Districts of Ghana. *Mineral Economics*, *26(1-2), 47-60.*

Davies, T. C., & Osano, O. (2005). Sustainable mineral development: a case study from Kenya. *Geological Society, London, Special Publications*, *250(1), 87-93.*

Ellis, F. (2000). Rural livelihoods and diversity in developing countries. *Oxford university press USA*

EMCA, (2016)."Environmental Management and Coordination Act", *Kenya Gazette. Government Printers, Nairobi, Kenya.*

Esteves, A. M. (2008). Mining and social development: Refocusing community investment using multi-criteria decision analysis. *Resources Policy*, *33(1), 39-47.*

Friend, M. A., & Kohn, J. P. (2018). Fundamentals of occupational safety and health. Rowman & Littlefield. *(Vol.3). African Development Bank.*

Fugiel, A., Burchart-Korol, D., Czaplicka-Kolarz, K., & Smoliński, A. (2017). Environmental impact and damage categories caused by air pollution emissions from the mining and quarrying sectors of European countries. *Journal of cleaner production*, *143*, *159-168.*

Funder, M., & Marani, M. (2013). Implementing national environmental frameworks at the local level A case study from Taita Taveta County, Kenya. *diis working paper 2013:06*

Ghorani-Azam, A., Riahi-Zanjani, B., & Balali-Mood, M. (2016). Effects of air pollution on human health and practical measures for prevention in Iran. *Journal of research in medical sciences: the official journal of Isfahan University of Medical Sciences*, *21.*

Gosar, M. (2004). Environmental impacts of metal mining Vplivi kovinskih rudnikov na okolje. *RMZ-Materials and geoenvironment*, *51(4), 2097-2107.*

Gualnam, C. (2008). Mining: Social and environmental impacts. *Mining and the Law in Africa pp 51-81*

Gupta, U. C., & Gupta, S. C. (1998). Trace element toxicity relationships to crop production and livestock and human health: implications for management. *Communications in Soil Science and Plant Analysis*, *29(11-14), 1491-1522.*

Hayes, K., & Wagner, F. (2008, November). Artisanal & small-scale mining and livelihoods in Africa. Common Fund for Commodities. *Prepared for International Seminar: "Small-scale Mining in Africa-A Case for Sustainable Livelihood*.

Hentschel, T. (2003). Artisanal and small-scale mining: challenges and opportunities. *Iied.*

Hilson, G. (2009). Small-scale mining, poverty and economic development in sub-Saharan Africa: An overview. *Resources Policy*, *34(1-2), 1-5.*

Hilson, G. (2011). Artisanal mining, smallholder farming and livelihood diversification in rural Sub-Saharan Africa: An introduction. *Journal of international development*, *23*(8), *1031-1041.*

Hilson, G. (2019). Why is there a large-scale mining 'bias' in sub-Saharan Africa?. *Land use policy*, *81*, *852-861.*

Hilson, G. M. (2004). Structural adjustment in Ghana: Assessing the impacts of mining-sector reform. *Africa Today*, *53-77.*

Hilson, G., & Banchirigah, S. M. (2009). Are alternative livelihood projects alleviating poverty in mining communities? Experiences from Ghana. *The Journal of Development Studies*, *45*(2), *172-196.*

Hilson, G., & McQuilken, J. (2014). Four decades of support for artisanal and small-scale mining in sub-Saharan Africa: a critical review. *The Extractive Industries and Society*, *1*(1), *104-118.*

Hilson, G., & Murck, B. (2000). Sustainable development in the mining industry: clarifying the corporate perspective. *Resources Policy*, *26*(4), *227-238.*

Horkel, A. D., Neubauer, W., Niedermayr, G., Okelo, R. E., Wachira, J. K., & Werneck, W. (1984). Notes on the geology and mineral resources of the southern Kenyan coast. *Mitt. Österr. Geol. Gesel, 77: 151-159.*

Horsley, J., Prout, S., Tonts, M., & Ali, S. H. (2015). Sustainable livelihoods and indicators for regional development in mining economies. *The Extractive Industries and Society*, *2(2), 368-380.*

Hoskin, W., Bird, G., & Stanley, T. (2000). Mining–facts, figures and environment. *Industry and environment*, *23, 4-8.*

ICMM (2014). The role of mining in national economies third edition. *The International Council on Mining and Metals report pp1-62*

International Fund for Agricultural Development (Ed.). (2001). The challenge of ending rural poverty. *Rural poverty report 2001.Oxford University Press.*

International Institute for Environment and Development. (2002). *Breaking new ground: mining, minerals and sustainable development; the report of the MMSD project. Earthscan.*

Jabareen, Y. (2008). A new conceptual framework for sustainable development. *Environment, development and sustainability*, *10*(2), *179-192.*

Kenya, & National Council for Law Reporting (Kenya). (2010). *Laws of Kenya: The Constitution of Kenya, 2010. National Council for Law Reporting.*

Kitula, A. G. N. (2006). The environmental and socio-economic impacts of mining on local livelihoods in Tanzania: A case study of Geita District. *Journal of cleaner production*, *14(3-4), 405-414.*

KNBS, (2019). Kenya Population and Housing Census Volume I: *Population by County and Sub-County.https://www.knbs.or.ke/?wpdmpro=2019-kenya-population-and-housing-census-volume-i-population-by-county-and-sub-county.*

Kröner, A., Muhongo, S., Hegner, E., & Wingate, M. T. D. (2003). Single-zircon geochronology and Nd isotopic systematics of Proterozoic high-grade rocks from the Mozambique belt of southern Tanzania (Masasi area): implications for Gondwana assembly. *Journal of the Geological Society*, *160(5), 745-757.*

Lechner, A. M., Baumgartl, T., Matthew, P., & Glenn, V. (2016). The impact of underground longwall mining on prime agricultural land: a review and research agenda. *Land Degradation & Development*, *27(6), 1650-1663.*

Loayza, N., & Rigolini, J. (2016). The local impact of mining on poverty and inequality: evidence from the commodity boom in Peru. *World Development*, *84, 219-234.*

Loayza, N., Teran, A. M. Y., & Rigolini, J. (2013). Poverty, inequality, and the local natural resource curse. *The World Bank.*

Makindi, S. M., Mutinda, M. N., Olekaikai, N. K., Olelebo, W. L., & Aboud, A. A. (2014). Human-wildlife conflicts: causes and mitigation measures in the Tsavo Conservation Area, Kenya. *International Journal of Science and Research (IJSR) ISSN (Online): 2319-7064*

Malagon Orjuela, E. A. (2012). How can mining contribute to sustainable development in Colombia?: a review of stakeholders perspective and policy gaps. *Master Thesis Series in Environmental Studies and Sustainability Science*.

Mghanga, M. (2011). Mining in Taita Taveta County: Prospects & Problems. *Nairobi: Heinrich Boll Stiftung*.

Mohamed, M. B., Ndinya, A., & Ogada, M. (2019). Influence of cost leadership strategy on the performance of medium-scale miners in Taita Taveta County, Kenya. *International Journal of Development and Management Review*, *14(1), 151-163*.

Mugenda, O. M., & Mugenda, A. G. (1999). *Research methods: Quantitative and qualitative approaches*. *Acts press*.

Muigua, K. (2019). Enhancing Benefits from Natural Resources Exploitation: An Appraisal of the Natural Resources *(Classes of Transaction Subject to Ratification by Parliament) Act, 2016. http://kmco.co.ke*

Mwakumanya, M. A., Maghenda, M., & Juma, H. (2016). Socio-economic and environmental impact of mining on women in Kasigau mining zone in Taita Taveta County. *Journal of Sustainable Mining*, *15(4), 197-204.*

Mwangi, M. R., & Mutiso, J. (2018). Influence of stakeholder involvement on the performance of mining projects in Taita Taveta County in Kenya. *Journal of International Business, Innovation and Strategic Management*, *1(6), 167-190.*

Mwanyumba, P. M., Mwang'ombe, A., Lenihan, E., Olubayo, F., Badamana, M. S., Wahome, R. G., & Wakhungu, J. W. (2010). Participatory analysis of the farming system and resources in Wundanyi location, Taita district, Kenya: a livestock perspective. *Livestock Research for Rural Development*, *22(2), 26.*

Mwitwa, J., German, L., Muimba-Kankolongo, A., & Puntodewo, A. (2012). Governance and sustainability challenges in landscapes shaped by mining: Mining-forestry linkages and impacts in the Copper Belt of Zambia and DR Congo. *Forest Policy and Economics*, *25, 19-30.*

Naja, G. M., & Volesky, B. (2009). Toxicity and sources of Pb, Cd, Hg, Cr, As, and radionuclides in the environment. *Heavy metals in the environment*, *8, 16-18.*

Nyamweno, I. M., Okoth, L. G., Tonui, W. K., & Kipkoech, T. (2015). Socio-economic, environmental and institutional dimensions of micro-scale traditional gold mining in Vihiga county, Kenya. *School of Spatial Planning, Natural Resources and Management [9]*

Ocholla, G. O., Bunyasi, M. M., Asoka, G. W., Pacha, O., Mbugua, H. K., Mbuthi, P., ... & Kamau, P. K. (2013). Environmental issues and socio-economic problems emanating from salt mining in Kenya; a case study of Magarini district. *International Journal of Humanities and Social Science*, *3(3), 213-223.*

Olawuyi, D. S. (2018). Environmental Impacts and Risks of Extractive Operations. In *Extractives Industry Law in Africa* (pp. 269-322). *Springer, Cham.*

Omer, S., & Jabeen, S. (2016). Exploring Karl Marx Conflict Theory in Education: Are Pakistani Private Schools Maintaining Status Quo?. *Bulletin of Education and Research*, *38(2), 195-202.*

Omollo, A. E. (2013). Socio-economic Factors Influencing Students Drop Out In Public Secondary Schools In Rongo District, Migori County, Kenya *(Doctoral dissertation, University of Nairobi,).*

Ostrom, E. (2008). The tragedy of the commons. *The new palgrave dictionary of economics*, *2*.

Olayide, P. B., Olawoye, J. E., & Olayide, O. E. (2013). Gender Dimensions of Rural Livelihoods in Artisanal and Small-scale Mining in Itesiwaju Local Government Area of Oyo State, Nigeria. *African Journal of Sustainable Development*, *3(1), 72-87.*

Oxfam, (2004)."Report on the health of mining communities", *available at:http://www.nodirtygold.org/pubs/dirty metals_HR.pdf (accessed 29 April 2011).*

Pandey, R. (2020). Mining, Agriculture Change and Resilience: Reflections from Indigenous Knowledge in the Anthropocene. In *Ecological and Practical Applications for Sustainable Agriculture* (pp. 395-410). *Springer, Singapore.*

Pedro, A. (2004). Mainstreaming Mineral Wealth in Growth and Poverty Reduction Strategies, Policy paper No. 1. *Economic Commission for Africa, Ethiopia.*

Pegg, S. (2006). Mining and poverty reduction: Transforming rhetoric into reality. *Journal of cleaner production*, *14(3-4), 376-387.*

Perry, M., & Rowe, J. E. (2015). Fly-in, fly-out, drive-in, drive-out: The Australian mining boom and its impacts on the local economy. *Local Economy*, *30(1), 139-148.*

Quadri, M. M., & Kalyankar, N. V. (2010). Drop out feature of student data for academic performance using decision tree techniques. *Global Journal of Computer Science and Technology*.

Rop, B. K. (2014). Economic and job creation potential of artisanal and small-scale Mining in Taita Taveta County, Kenya. *Natural Resources Management for Sustainable Development in Kenya Extractive IndustryUNDP, New York. pp 72-75*. www.undp.org

Ross, M. R., McGlynn, B. L., & Bernhardt, E. S. (2016). Deep impact: Effects of mountaintop mining on surface topography, bedrock structure, and downstream waters. *Environmental science & technology*, *50(4), 2064-2074.*

Shoko, P. M., & Mwitwa, J. (2015). Socio-economic impact of small scale emerald mining on local community livelihoods: the case of Lufwanyama district. *International journal of education and research*, *3(6), 14.*

Sincovich, A., Gregory, T., Wilson, A., & Brinkman, S. (2018). The social impacts of mining on local communities in Australia. *Rural Society*, *27(1), 18-34*.

Spiegel, S. J. (2012). Microfinance services, poverty and artisanal mine workers in Africa: In search of measures for empowering vulnerable groups. *Journal of International Development*, *24(4), 485-517.*

Starke, L. (2002). Breaking new ground: mining, minerals, and sustainable development*: the report of the MMSD project (Vol. 1). Earthscan. Pages 450*

Stevenson, L., & St-Onge, A. (2005). Support for growth-oriented, women entrepreneurs in Kenya. *International labour organization.*

Taita Taveta County Government (2013). County Integrated Development Plan. County Government of Taita Taveta. *Nairobi: Government Printers*. *www.cog.go.ke*

Taita Taveta County Government (2013) "Supporting Quality Life for the People of Taita Taveta". *The First Taita Taveta County Integrated Development Plan 2013-2017*

Taita Taveta County Government(2018) "Supporting Quality Life for the People of Taita Taveta". *The First Taita Taveta County Integrated Development Plan 2018-2022*

Tundui, H. P. (2012). Gender and small business growth in Tanzania: the role of habitus *(Doctoral dissertation, University of Groningen, SOM research school).*

Velde, B. (1995). Composition and mineralogy of clay minerals. In *Origin and mineralogy of clays (pp. 8-42). Springer, Berlin, Heidelber.*

Waiganjo, R. W. (2019). Gender Relations and Women's Economic Empowerment in Artisanal Gemstone Mining in Taita Taveta County, Kenya *(PhD thesis, University of Nairobi).*

WCED, S. W. S. (1987). World commission on environment and development. *Our common future*, *17, 1-91.*

Weller, S., & O'Neill, P. (2014). De-industrialisation, financialisation and Australia's macro-economic trap. *Cambridge Journal of Regions, Economy and Society*, *7(3), 509-526.*

Wetzlmaier, M. (2012). Cultural impacts of mining in indigenous peoples' ancestral domains in the Philippines. *ASEAS-Austrian Journal of South-East Asian Studies*, *5(2), 335-344.*

World Development Indicators (2015). *World Bank Group https://openknowledge.worldbank.org/handle/10986/21634*

Yakovleva, N. (2007). Perspectives on female participation in artisanal and small-scale mining: A case study of Birim North District of Ghana. *Resources Policy*, *32(1-2), 29-41.*

Zollo, N. J. (2019). A Study on Artisanal and Small-Scale Gemstones Mining in Taita Taveta County, Kenya *(Doctoral dissertation, University of Ghana).*

Appendix 1: Study Questionnaire

Introduction:

My name is Irene Wakio Mwakesi, a PhD student at Wangari Maathai Institute. I am conducting a study on **the impacts and effects of mining on socio-cultural, livelihood and environment in Taita Taveta County, Kenya** for my project.

The study seeks to research into the positive and negative impacts of mining activities and the effects of the mineral sector on the socio-cultural aspects of the communities in Taita's Kamtonga and Mkuki mining region. It also seeks to find out the coping strategies of the impacts facing the communities surrounded by mining and other communities as well.

The information you give in response to this questionnaire will be held in confidence and will only be used for this project. If at any time you feel uncomfortable with this questionnaire you may feel free to terminate your response.

Impacts of Mining on Socio-Cultural Aspects

A: Personal Information *(Tick as appropriate)*	
1	Name (Optional):	
2	Age in Years:	
3	Gender ( ) Male ( ) Female	
4	Marital status **(1)** Single **(2)** Married **(3)** Widowed **(4)** Divorced	
5	Home District :	
6	How long have you resided in this area? **(1)** 6-10 years **(2)** 11-15 years **(3)** 16-20 years **(4)** Over 20 years	
7	Education Level: **(1)** None **(2)** Primary **(3)** Secondary **(4)** Tertiary	
8	**B: QUESTIONS ON THE MINING IMPACT ON SOCIO-CULTURAL ASPECTS OF MINERS AND COMMUNITIES**	

9	**Socio-Cultural patterns and values before mining activities began** *SCALE:* 1=Strongly Disagree 2= Disagree 3= Agree 4=Strongly Agree	Write your response number in the unshaded boxes below
10	**Indigenous Land** Before mining activities started in Taita Taveta: *Indicate if you: 1=Strongly Disagree 2=Disagree 3=Agree 4=Strongly Agree*	
	The land was owned by local people	
	They inherited ancestral land	
	Local people lived on communal land	
	Local people leased land and lived there	
11	**Communal /social relations (Peaceful Habitation**): Before mining activities started in Taita Taveta: *Indicate using scale 1-4 (as above)*	
	People lived in villages	
	There was strong family unity	
	Children played on one compound peacefully together	
	Communities cooked and ate together peacefully	
12	**Information sharing** Before mining activities started in Taita Taveta: *Indicate using scale 1-4 (as above)*	
	There were no secrets in information sharing among communities	
	Community leaders kept people informed of all the happenings	
	People shared special community events	

	Men and women worked together without discrimination		
13	**Substance Abuse** Before mining activities started in Taita: *Indicate using scale 1-4 (as above)*		
	Communities engaged in traditional brews and alcohol		
	Taita Taveta people indulged in drugs		
14	**Traditional / Cultural activities** Before mining activities started in Taita: *Indicate using scale 1-4 (as above)*		
	People upheld their traditional and cultural activities		
	Cultural dances occupied leisure time		
	Events like weddings, childbirth, and child naming were very important for families		
	Taita people had their own dressing culture for men and women		
	Hunting and gathering was part of people's important social activity		
15	**Beliefs** Before mining activities started in Taita: *Indicate using scale 1-4 (as above)*		
	The Taita communities had already been into religion mainly Anglican and Catholic and Muslim		
	They had their own sacred beliefs as well		
16	**Moral behaviour** Before mining activities started in Taita: *Indicate using scale 1-4 (as above)*		
	Men and women did not mix in public village meetings or churches		
	Sex education was sacred and aunties and uncles took the mantle to talk about it to the youth		

17	**Education** Before mining activities started in Taita: *Indicate using scale 1-4 (as above)*	
	Formal education existed	
	Boys and girls went to school	
	Informal education was not known.	
	You either went to school or you didn't	
18	**Environment** Before mining activities started in Taita: *Indicate using scale 1-4 (as above)*	
	Very thick forests existed all over Taita	
	Communities drew very clean and fresh water from the rivers	
	Animal life was uninterrupted both domestic and wild animals	
19	**Economic gains** Before mining activities started in Taita: *Indicate using scale 1-4 (as above)*	
	Taita people were very wealthy	
	Economic trade comprised of farm produce like vegetables, cereals,	
	People also traded in animals produce like milk, meat, vegetables, eggs and sale of animals like cows, goats and sheep	
	Market centres existed even before mining started	
20	Before mining activities started in Taita: *Indicate using scale 1-4 (as above)*	
	Men went to herd animals	
	Men also took turns to run other forms of local ranches known as "Maranu" in Kitaita	
	Modern ranches did not exist before mining started	

21	**Weather** Before mining activities started in Taita Taveta: *Indicate using scale 1-4 (as above)*	
	Famine and poverty was only seasonal depending on how the rains performed	
	. Every homestead had food	
	The weather was good throughout because of the forests	
	Effects of mining activities on social structure and cultural dynamics: **Socio-cultural patterns and values after mining started** *SCALE:* 1=Strongly Disagree 2= Disagree 3= Agree 4=Strongly Agree	Write your response number in the unshaded boxes below
22	**Indigenous Land** *Indicate if you: 1=Strongly Disagree 2=Disagree 3=Agree 4=Strongly Agree*	
	On the onset of mining activities in Taita, many people lost their land	
	Many leased their land to miners	
	Communal land was not touched	
	Ancestral land was not touched	
23	**Peaceful Habitation** *Indicate if you: 1=Strongly Disagree 2=Disagree 3=Agree 4=Strongly Agree*	
	Mining activities disrupted peaceful habitation in the villages	
	Families no longer spend time together because of working at the mines	
	Children's lives have been interfered with by the changed family	

	occupation	
	Sharing community or extended family activities has been disrupted	
	People have become busier than before with both employment and farming	
24	**Information sharing** *Indicate if you: 1=Strongly Disagree 2=Disagree 3=Agree 4=Strongly Agree*	
	There is a lack of sufficient consultation when a new mining site is starting	
	Community is not engaged	
	Lack of accurate information on mining impacts	
25	**Traditional/Cultural** *Indicate if you: 1=Strongly Disagree 2=Disagree 3=Agree 4=Strongly Agree*	
	The onset of mining brought in an influx of none residents into the county	
	Tradition and culture has been altered because of the presence of a mixed population	
	Communities no longer live in trust because of secret remunerations supposedly given	
	Most of the cultural activities of the Taitas living around mining areas have died due to the changed occupations in the area	
	Mining areas have become cosmopolitan	
	Economic gains have altered the dressing and music cultures of the Taita Taveta people living in the mining areas.	
	It is no longer secure to have open ceremonies in the nights like before	
	Sacred beliefs and artefacts have no prominence any more	
	Religious platforms have also changed with more protestant churches	

	in the county.	
26	**Moral behaviour** *Indicate if you: 1=Strongly Disagree 2=Disagree 3=Agree 4=Strongly Agree*	
	Mining has introduced a new lifestyle to the communities	
	Alcoholism and drug addiction has escalated	
	More girls are dropping out of school to do prostitution	
	Family neglect is on the rise	
	Also, divorces and polygamy habits are on the rise	
27	**Education** *Indicate if you: 1=Strongly Disagree 2=Disagree 3=Agree 4=Strongly Agree*	
	The communities have not been given any formal or informal education on mining	
	The women in particular fall victim of being conned because of ignorance on mining trade.	
	Normal school education has improved	
	Local people have learnt about mines and minerals	
	Girls and boys go through primary and secondary education	
	There are no school dropouts as a result of mining	
28	**Environment** *Indicate if you: 1=Strongly Disagree 2=Disagree 3=Agree 4=Strongly Agree*	
	Mining activities have cleared the forests	
	Underground Mining has interfered with water beds and rivers have dried up	
	Water is contaminated	
	Natural habitation and indigenous trees have been cleared	

	There is more visibility of NEMA and Forest department officials	
	Control of dust is lacking	
	Miners are not protected against mining hazards	
	KWS activities should be a factor during EIA and mining activities	
29	**Pastoralism** *Indicate if you: 1=Strongly Disagree 2=Disagree 3=Agree 4=Strongly Agree*	
	Except for the expansive ranches, traditional herders are hardly spotted	
	Due to mining, there is no wild animal scare to the herders anymore	
	Ranch animal population has grown due to safety in the mining areas	
	There is no enough grass and shrubs to feed the cattle due to land damage caused by mining	
	The herders are mostly of Maasai origin working at the ranches	
30	**Infrastructure (Construction)** *Indicate if you: 1=Strongly Disagree 2=Disagree 3=Agree 4=Strongly Agree*	
	Mining activities have come along with roads	
	Mining activities have come along with better-structured schools	
	Mining activities have come along with shopping centres	
	Mining activities have come along with, churches	
	Mining activities have come along with market centres	
	Mining activities have come along with health centres	
	Houses have improved from grass and mud to bricks, stone and iron sheets	
31	**Influx of workers** *Indicate if you: 1=Strongly Disagree 2=Disagree 3=Agree*	

	4=Strongly Agree	
	There has been an influx of workers from other parts of Taita and outside Taita.	
	The influx of workers is a positive value for people of Taita	
	The influx of workers has brought in negative opportunities for the Taita people	
	This influx of workers has caused communities to lose their land	
	The influx of workers has created job	
	The influx of workers has interfered with the Taita culture	
	The influx of workers has introduced conflict and insecurity	
	Effects of mining activities Development *SCALE:* 1=Strongly Disagree 2= Disagree 3= Agree 4=Strongly Agree	Write your response number in the unshaded boxes below
32	**Job creation** *Indicate if you: 1=Strongly Disagree 2=Disagree 3=Agree 4=Strongly Agree*	
	Mining has brought business creation	
	Mining has brought wealth creation	
	Mining introduced small-scale trading,	
	Women are also involved in selling mines	
	Creation of food vendors in mining areas	
	Creation of transportation and commuting business	
33	**Population**	
	The population in Kamtonga and Mkuki has continued to increase due to the attractive mining	
	There is large human traffic in these areas than before mining started	

	Mixed marriages have contributed to population growth	
34	**Government and Politics**	
	Mining has encouraged political awareness in the county	
	Voter register has grown	
	Insecurity has also creped in	
	The county government has not been able to manage conflicts in the mining areas	
	The county government has not been very visible in administering mining regulations	
35	**Economic changes**	
	Mining has introduced centres where workers while away time	
	Locals and miners are financially stable	
	Increased tax returns	
	The local small scale miners have not had any economic gains	
	The people's living standards have not improved	
36	In case I require more information can I contact you, please? Yes ( ) No ( )	

Effects of mining on household livelihood income, assets and activities	
B: INCOME SOURCES AND LEVELS *Tick as appropriate or write the number in the last column*	
37	Are you involved with mining activities in this area? Yes ( ) No ( )	
	(b) If yes indicate the income activities in the mines you are engaged in from the list below: Digger ( ) Crushing ( ) Sifting ( ) Broking ( ) Mineral trader ( ) Food Vendor ( ) Technician/Mechanic ( ) Driver ( ) Loader ( )	
	(c) If No then indicate what you do around this area? Farming ( ) School Teacher ( ) House help ( ) Herder ( ) Shop keeper ( )	
38	What skills do you possess that you use to support your household livelihood? (*kindly list below*)	
39	What is the monthly income earned by you from your activities in this area? (*indicate on the last column as appropriate*) 1=500-2000 2=2000-4000 3=4000-6000 4=Above 6000	
40	What are your other sources of income within the mining areas (kindly list	

41	What financial proportion does mining contribute to your livelihood *(i) In a good month ………………………* *(ii) In a bad month………………………* *(iii)Other……………………………………*	
42	Would you say that mining has enhanced the livelihoods of your household in general? (*tick as appropriate*) Yes ( ) No ( )	
43	By either agreeing or disagreeing indicate how you spend your income *SCALE:1=Strongly disagree 2=Disagree 3=Agree 4=Strongly agree*	
	(i) Food	
	(ii) Education	
	(iii)Health	
	(iv)Clothing	
	(v) Transport	
	(vi)Church	
	(vii) Remittance to relatives and friends	
	(viii) Social Responsibility	
44	By either agreeing or disagreeing indicate what positive benefits have mining brought to your household livelihood *SCALE: 1=Strongly disagree 2=Disagree 3=Agree 4=Strongly agree*	
	(i) Financial wealth	
	(ii) Jobs	
	(iii)Sustainable education system	

	(iv)Health Centers	
	(v) Security	
	(vi)Commuting transport	
	(vii) Social exposure	
	(viii) Mining Education	
	(ix)Improved living standards	
	(x) Market centres	
45	By either agreeing or disagreeing indicate what negative attributes has mining brought to your household livelihood *SCALE: 1=Strongly disagree 2=Disagree 3=Agree 4=Strongly agree*	
	(i) Poverty	
	(ii) Insecurity	
	(iii)Tribalism	
	(iv)Alcoholism problems in the family	
	(v) Loss of family assets like houses, farming tools, cattle and land	
	(vi)Natural source of income diminished	
	(vii) Illiteracy is on the rise	
	(viii) Family Feuds or conflicts	
	(ix)School dropouts	
	(x) Prostitution	
	C: ASSETS ***Tick as appropriate or write the number in the last column***	
46	Mining has influenced my livelihood assets listed below *SCALE: 1=Strongly disagree 2=Disagree 3=Agree 4=Strongly agree*	
	(i) Permanent Houses	
	(ii) Trees (forests and firewood)	

	(iii)Livestock	
	(iv)Natural sources of income (e.g farming)	
	(v) Shops (kiosk)	
	(vi)Working tools/equipment	
47	Through mining activities, I bought livelihood assets *SCALE: 1=Strongly disagree 2=Disagree 3=Agree 4=Strongly agree*	
	(i) Farming tools	
	(ii) Land	
	(iii)House	
	(iv)A car	
	(v) Livestock	
	(vi)Working tools	
48	As a result of mining activities in this area, I have lost livelihood assets *SCALE: 1=Strongly disagree 2=Disagree 3=Agree 4=Strongly agree*	
	(i) Land	
	(ii) Livestock	
	(iii)House	
	(iv)Working tools	
	(v) Trees	
49	Do you own any tools and or equipment that would help you to be more productive in your occupation *(tick appropriately)* Yes ( ) No ( )	
50	Has mining helped you to improve your livelihood resources like your general abilities of farming tools, and other personal assets? Yes ( ) No ( )	
51	Does your household receive any benefits to help you improve on your assets and general livelihood?	

	Yes ( ) No ( )	
52	If Yes are you satisfied with the benefits you receive? Yes ( ) No ( )	
53	Give other examples of the benefits you receive if any. *(i)*	
	(ii)	
	(iii)	
	(iv)	
	(v)	
	D: ACTIVITIES *Tick as appropriate or write the number in the last column*	
54	Mining operations have added value to the livelihood with the following activities such as: True ( ) False ( )	
	(i) Farming	
	(ii) Herding	
	(iii)Poultry keeping	
	(iv)Beekeeping	
	(v) Fundraising (Harambees)	
55	Mining activities have robbed residents of their livelihood activities such as: True ( ) False ( )	
	(i) Farming	
	(ii) Herding	
	(iii)Poultry keeping	
	(iv)Beekeeping	
	(v) Fundraising (Harambees*)*	

56	Community members who work in the mining industry spend their time out of work doing the activities listed below : *SCALE: 1=Strongly disagree 2=Disagree 3=Agree 4=Strongly agree*	
	(i) Social activities like drinking	
	(ii) Constructing or repairing their homesteads	
	(iii) Religious activities	
	(iv) Weddings or funerals	
	(v) Family meetings	
	(vi) Communal activities like Nyumba Kumi (Ten houses) meetings and Chiefs Barazas	
	(vii) Parents Teachers Association meetings	
	(viii) Cutting trees for firewood	
	(ix) Socializing in shopping and market centres	
	(x) Recreational activities	
57	To what extent do you agree or disagree regarding the impact of mining on economic activities? *SCALE: 1=Strongly disagree 2=Disagree 3=Agree 4=Strongly agree*	
	(i) Mining operations have positively impacted main economic activities in Taita	
	(ii) Agriculture has greatly improved due to mining activities in Taita	
	(iii) Gainful employment came due to mining activities in Taita	
	(iv) Mining companies have shared revenue accrued by supporting development projects like construction of schools, dispensaries, social halls and market centres in Taita	
	(v) Mining activities have also contributed to improving social services like health and education in Taita	
	(vi) Mining operations have raised livelihood standards through income levels per family in Taita	
	(vii) Food production has increased	

	(viii) Improvement of roads has made it easy to access agricultural markets, farms and ranches in Taita	
	(ix) There is adequate housing as a result of mining activities in Taita	
	(x) Mining operations have enhanced security for households	
	(xi) Mining operations have enhanced security for business centres	
58	Would you say that mining has enhanced the livelihood of your household in general? Yes ( ) No ( )	
59	In case I require more information can I contact you, please? Yes ( ) No ( )	

THANK YOU

Record Sheet 1

Mining Approaches and Characteristics

(key in observed information)

Mining Name	Mining Identity eg.	Mining approach eg.	Characteristics e.g	Environmental effects
	1. Open-pit 2. Underground 3. Placer mining 4. Abandoned mines 5. Mining extraction 6. Disposal of overburdened waste 7. Beneficiation(grinding or milling	1. Removal of overburden (layers) 2. Hydraulic mining process(bull dozers, dredges, or hydraulic jets of water) 3. Stopping or block caving 4. Sorting out the waste pile 5. Excavated 6. Specialized heavy equipment and machinery(loaders, hauliers, dump trucks) 7. Grinding or milling chemical separation techniques 8. Leaching	1. Strip Mining 2. Deep in the ground 3. Pits below groundwater level 4. Stream sediments and flood plans 5. Stream beds 6. Horizontal tunnels and shafts 7. Enormous overburden 8. High volume wastes called 'tailings' 9. Open pits	
Kamtonga: 1.				
2.				
3.				

4				
Mkuki				
1.				
2.				
3.				

Record Sheet 2

Mining operations proximity to urban infrastructure

Key distance in kilometres (Tools used GBS)

Mines	**Residential Areas**	**Water Sources**	**Water Reticulation systems**	Churches	Shopping centres
Kamtonga					
1.					
2.					
3.					
4.					
Mkuki					
1.					
2.					
3.					
4.					

Record Sheet 3

Activity influence on topography

Key 1=none 2=damaged 3=moderately damaged 4= highly damaged 5=extensively damage (TOOL-….)

Mines	At site	Valleys	Plains	Leach at Dump piles	Natural water head	Hills	Wetlands
Kamtonga							
1	**N**						
	S						
	E						
	W						
2.	**N**						
	S						
	E						
	W						
3.	**N**						
	S						
	E						
	W						
4.	**N**						
	S						
	E						
	W						
Mkuki							
1.	**N**						
	S						
	E						

	W						
2.	N						
	S						
	E						
	W						
3.	N						
	S						
	E						
	W						
4.	N						
	S						

Record Sheet 4

Activity influence on Vegetation

(Scale 1-5)1=none (ground is bare) 2=sparse 3=moderate and lush 4= dense and lush 4= very dense and green

Mines	At site	General categories of trees	Shrubs	Grass	Animal Life
Kamtonga					
1.	N				
	S				
	E				
	W				
2.	N				
	S				

	E				
	W				
3.	**N**				
	S				
	E				
	W				
4.	**N**				
	S				
	E				
	W				
Mkuki					
1.	**N**				
	S				
	E				
	W				
2.	**N**				
	S				
	E				
	W				
3.	**N**				
	S				
	E				
	W				

Record Sheet 5

Mining effects on Air

Key = Dust on a scale of 1-5

1=none 2=Very thin 3= Thin 4=Thick 5= Very thick

Mining	Excavations	Selected Time of Day	Observation
Kamtonga Minefields			
1.	**Blasting (Noise and dust)**	**7 am**	
		10 am	
		2 pm	
		6 pm	
	Transportation of materials (dust)	**7 am**	
		10 am	
		2 pm	
		6 pm	
	Wind Erosion (dust)	**7 am**	
		10 am	
		2 pm	
		6 pm	
	Fugitive dust from tailings(mine dump) facilities	**7 am**	
		10 am	
		2 pm	
		6 pm	
	Stock Piles	**7 am**	

		10 am	
		2 pm	
		6 pm	
	Waste dumps	7 am	
		10 am	
		2 pm	
		6 pm	
	Haul roads	7 am	
		10 am	
		2 pm	
		6 pm	
	Exhaust Emissions (cars, trucks, heavy equipment)	7 am	
		10 am	
		2 pm	
		6 pm	
	Gas emissions	7 am	
		10 am	
		2 pm	
		6 pm	
2.	**Blasting (Noise and dust)**	7 am	
		10 am	
		2 pm	
		6 pm	
	Transportation of materials (dust)	7 am	
		10 am	
		2 pm	

		6 pm	
	Wind Erosion (dust)	7 am	
		10 am	
		2 pm	
		6 pm	
	Fugitive dust from tailings(mine dump) facilities	7 am	
		10 am	
		2 pm	
		6 pm	
	Stock Piles	7 am	
		10 am	
		2 pm	
		6 pm	
	Waste dumps	7 am	
		10 am	
		2 pm	
		6 pm	
	Haul roads		
	Exhaust Emissions (cars, trucks, heavy equipment)	7 am	
		10 am	
		2 pm	
		6 pm	
	Gas emissions	7 am	
		10 am	
		2 pm	
		6 pm	

3.	Blasting (Noise and dust)	7 am	
		10 am	
		2 pm	
		6 pm	
	Transportation of materials (dust)	7 am	
		10 am	
		2 pm	
		6 pm	
	Wind Erosion (dust)	7 am	
		10 am	
		2 pm	
		6 pm	
	Fugitive dust from tailings(mine dump) facilities	7 am	
		10 am	
		2 pm	
		6 pm	
	Stock Piles	7 am	
		10 am	
		2 pm	
		6 pm	
	Waste dumps	7 am	
		10 am	
		2 pm	
		6 pm	

		Haul roads	7 am	
			10 am	
			2 pm	
			6 pm	
		Exhaust Emissions (cars, trucks, heavy equipment)	7 am	
			10 am	
			2 pm	
			6 pm	
		Gas emissions	7 am	
			10 am	
			2 pm	
			6 pm	
4.		Blasting (Noise and dust)	7 am	
			10 am	
			2 pm	
			6 pm	
		Transportation of materials (dust)	7 am	
			10 am	
			2 pm	
			6 pm	
		Wind Erosion (dust)	7 am	
			10 am	
			2 pm	
			6 pm	
		Fugitive dust from tailings(mine dump) facilities	7 am	
			10 am	

		2 pm	
		6 pm	
	Stock Piles	**7 am**	
		10 am	
		2 pm	
		6 pm	
	Waste dumps	**7 am**	
		10 am	
		2 pm	
		6 pm	
	Haul roads	**7 am**	
		10 am	
		2 pm	
		6 pm	
	Exhaust Emissions (cars, trucks, heavy equipment)	**7 am**	
		10 am	
		2 pm	
		6 pm	
	Gas emissions	**7 am**	
		10 am	
		2 pm	
		6 pm	
Mkuki			
	Blasting (Noise and dust)	**7 am**	
		10 am	
		2 pm	

		6 pm	
	Transportation of materials (dust)	7 am	
		10 am	
		2 pm	
		6 pm	
	Wind Erosion (dust)	7 am	
		10 am	
		2 pm	
		6 pm	
	Fugitive dust from tailings(mine dump) facilities	7 am	
		10 am	
		2 pm	
		6 pm	
	Stock Piles	7 am	
		10 am	
		2 pm	
		6 pm	
	Waste dumps	7 am	
		10 am	
		2 pm	
		6 pm	
	Haul roads	7 am	
		10 am	
		2 pm	
		6 pm	
	Exhaust Emissions (cars, trucks,	7 am	

		heavy equipment)	10 am	
			2 pm	
			6 pm	
		Gas emissions	7 am	
			10 am	
			2 pm	
			6 pm	
2.		Blasting (Noise and dust)	7 am	
			10 am	
			2 pm	
			6 pm	
		Transportation of materials (dust)	7 am	
			10 am	
			2 pm	
			6 pm	
		Wind Erosion (dust)	7 am	
			10 am	
			2 pm	
			6 pm	
		Fugitive dust from tailings(mine dump) facilities	7 am	
			10 am	
			2 pm	
			6 pm	
		Stock Piles	7 am	
			10 am	
			2 pm	

		6 pm	
	Waste dumps	7 am	
		10 am	
		2 pm	
		6 pm	
	Haul roads	7 am	
		10 am	
		2 pm	
		6 pm	
	Exhaust Emissions (cars, trucks, heavy equipment)	7 am	
		10 am	
		2 pm	
		6 pm	
	Gas emissions	7 am	
		10 am	
		2 pm	
		6 pm	
3.	**Blasting (Noise and dust)**	7 am	
		10 am	
		2 pm	
		6 pm	
	Transportation of materials (dust)	7 am	
		10 am	
		2 pm	

		6 pm	
	Wind Erosion (dust)	7 am	
		10 am	
		2 pm	
		6 pm	
	Fugitive dust from tailings(mine dump) facilities	7 am	
		10 am	
		2 pm	
		6 pm	
	Stock Piles	7 am	
		10 am	
		2 pm	
		6 pm	
	Waste dumps	7 am	
		10 am	
		2 pm	
		6 pm	
	Haul roads	7 am	
		10 am	
		2 pm	
		6 pm	
	Exhaust Emissions (cars, trucks, heavy equipment)	7 am	
		10 am	
		2 pm	
		6 pm	
	Gas emissions	7 am	

		10 am	
		2 pm	
		6 pm	
4.	**Blasting (Noise and dust)**	7 am	
		10 am	
		2 pm	
		6 pm	
	Transportation of materials (dust)	7 am	
		10 am	
		2 pm	
		6 pm	
	Wind Erosion (dust)	7 am	
		10 am	
		2 pm	
		6 pm	
	Fugitive dust from tailings(mine dump) facilities	7 am	
		10 am	
		2 pm	
		6 pm	
	Stock Piles	7 am	
		10 am	
		2 pm	
		6 pm	
	Waste dumps	7 am	
		10 am	
		2 pm	

		6 pm	
	Haul roads	**7 am**	
		10 am	
		2 pm	
		6 pm	
	Exhaust Emissions (cars, trucks, heavy equipment)	**7 am**	
		10 am	
		2 pm	
		6 pm	
	Gas emissions	**7 am**	
		10 am	
		2 pm	
		6 pm	

Record Sheet 6

Mine Activities on Noise and Earth Vibrations

Key for noise and vibration =observation

Mines	Activity	Noise • **1=none** • **2=minimum** • **3=moderate** • **4=loud** • **5=very loud**	Earth Vibrations • **1=none** • **2=minimum** • **3=moderate** • **4=very loud**
Kamtonga			
1.	Vehicle engines		
	Loading and unloading into steel dumpers		

	Chutes		
	Power generations		
	Shovelling		
	Ripping		
	Drilling		
	Blasting		
	Transport		
	Crash grinding		
	Stock Piling		
2.	Vehicle engines		
	Loading and unloading into steel dumpers		
	Chutes		
	Power generations		
	Shovelling		
	Ripping		
	Drilling		
	Blasting		
	Transport		
	Crash grinding		
	Stock Piling		
3.	Vehicle engines		
	Loading and unloading into steel dumpers		
	Chutes		
	Power generations		
	Shovelling		

	Ripping		
	Drilling		
	Blasting		
	Transport		
	Crash grinding		
	Stock Piling		
4.	Vehicle engines		
	Loading and unloading into steel dumpers		
	Chutes		
	Power generations		
	Shovelling		
	Ripping		
	Drilling		
	Blasting		
	Transport		
	Crash grinding		
	Stock Piling		
Mkuki			
1.	Vehicle engines		
	Loading and unloading into steel dumpers		
	Chutes		
	Power generations		
	Shovelling		
	Ripping		
	Drilling		

	Blasting		
	Transport		
	Crash grinding		
	Stock Piling		
2.	Vehicle engines		
	Loading and unloading into steel dumpers		
	Chutes		
	Power generations		
	Shovelling		
	Ripping		
	Drilling		
	Blasting		
	Transport		
	Crash grinding		
	Stock Piling		
3.	Vehicle engines		
	Loading and unloading into steel dumpers		
	Chutes		
	Power generations		
	Shovelling		
	Ripping		
	Drilling		
	Blasting		
	Transport		
	Crash grinding		

	Stock Piling		
4.	Vehicle engines		
	Loading and unloading into steel dumpers		
	Chutes		
	Power generations		
	Shovelling		
	Ripping		
	Drilling		
	Blasting		
	Transport		
	Crash grinding		
	Stock Piling		

Appendix 2: Key Informants Interview Guide (KII)

My name is Irene Wakio Mwakesi a PhD student at the University of Nairobi. I am conducting a study on **THE IMPACTS AND EFFECTS OF MINING ON SOCIO-CULTURAL PATTERNS, LIVELIHOOD AND ENVIRONMENT IN TAITA TAVETA COUNTY, KENYA** for my project paper.

The study seeks to research into the positive and negative impacts of mining activities and the impacts of the mineral sector on the socio-cultural aspects, livelihood and environment of the communities in Taita's Kamtonga and Mkuki mining region. It also seeks to find out the coping strategies of the impacts facing the communities surrounded by mining and other communities as well.

The information you will provide will be useful in bringing to light mitigating approaches for social-cultural, livelihood and environmental impacts as a result of mining in the county and beyond.

If at any time you feel uncomfortable with this questionnaire you may feel free to terminate your response

You are kindly requested, as a key leader in the Taita Taveta County, to spare some of your time to respond to the questionnaire below.

The information you give in respect to this questionnaire will be held in confidence and will only be used for this project.

1. Name (Optional): ………………………………………………………

2. Title:………………………………………………………………………

1. Mining projects are preceded by several professional steps such as the Environmental Impact Assessment (EIA) before exploration and clearing of vegetation. During this phase are the residents of the affected areas involved in the discussions or informed of the emerging developments?

   ( ) Yes   ( ) No

Please briefly explain what happens

…………………………………………………………………………………………………
…………………………………………………………………………………………………
…………………………………………………………………………………………………
…………………………………………………………………………………………………
…………………………………………………………………………………………………
…………………………………………………………………………………………………
…………………………………………………………………………………………………
………………………………………………………

2. In your view, how has mining activities affected the socio-cultural and livelihood aspects of the communities in the county?

…………………………………………………………………………………………………
…………………………………………………………………………………………………
…………………………………………………………………………………………………
…………………………………………………………………………………………………
…………………………………………………………………………………………………
…………………………………………………………………………………………………
…………………………………………………………………………………………………
………………………………………………………

3. What does the population comprise of?

( ) Locals   ( ) Immigrants   ( ) Migrants

(b) Kindly indicate demographic figures for each group

…………………………………………………………………………………………………
…………………………………………………………………………………………………
…………………………………………………………………………………………………
…………………………………………………………………………

4. At any time have indigenous people been forced to migrate due to mining activities?   ( ) Yes   ( ) No

If yes please explain how this was done and the impact thereof.

…………………………………………………………………………………………………
…………………………………………………………………………………………………
…………………………………………………………………………………………………
…………………………………………………………………………………………………
…………………………………………………………………………………………………
………………………………………………………………

5. Kindly explain how the infiltration of immigrants has affected the traditions and cultures of the Taita Taveta communities.

…………………………………………………………………………………………………
…………………………………………………………………………………………………
…………………………………………………………………………………………………
…………………………………………………………………………………………………
…………………………………………………………………………………………………
…………………………………………………………………………………………………
…………………………………………………………………………………………………
………………………………………………………………

6. How would you describe the quality of the following environmental aspects concerning mining activities:

   (a) The air and water status

   ………………………………………………………………………………………………
   ………………………………………………………………………………………………
   ………………………………………………………………………………

   (b) Availability and quality of food

   ………………………………………………………………………………………………
   ………………………………………………………………………………………………
   ………………………………………………………………………………

   (c) Level of dust and noise people are exposed to

   ………………………………………………………………………………………………
   ………………………………………………………………………………………………
   ………………………………………………………………………………

   (d) Safety of the people or communities

   ………………………………………………………………………………………………
   ………………………………………………………………………………………………
   ………………………………………………………………………………

   (e) Livelihood quality of the community groups e.g Youth, Women, Miners, Small traders, Cattle herders, Transporters, Food vendors, School students etc.

   ………………………………………………………………………………………………
   ………………………………………………………………………………………………
   ……………………………………………………………………………….

7. Has there been any land or asset loss among the communities as a result of mining activities? ( ) Yes   ( ) No

   Please explain

   ………………………………………………………………………………………………
   ………………………………………………………………………………………………
   ………………………………………………………………………………………………
   ………………………………………………………………………………………………
   ……………………………………………………………………………

8. Has there been any conflict due to mining activities? ( ) Yes   ( ) No

(a) If yes what role did the county government play to resolve the issue?
………………………………………………………………………………………
………………………………………………………………………………………
………………………………………………………………………………

(b) If no, are communities able to access the mining areas
………………………………………………………………………………………
………………………………………………………………………………………
………………………………………………………………………………………
………………………………………………………………………………

(c) Are they in control of what goes on in the mining fields? Yes ( )   No ( )
Please explain
………………………………………………………………………………………
………………………………………………………………………………………
………………………………………………………………………………………
………………………………………………………………………………

(d) Do they benefit from the resources accrued?   Yes ( )   No ( )
Please explain
………………………………………………………………………………………
………………………………………………………………………………………
………………………………………………………………………………………
………………………………………………………………………………………
………………………………………………………………………………

9. Has mining been an added economic value to the county? Yes ( )   No ( )
10. Kindly explain
………………………………………………………………………………………
………………………………………………………………………………………
………………………………………………………………………………………
………………………………………………………………………………………
………………………………………………………………………………

11. Describe the culture of the Taita Taveta people and explain if foreign immigrants have
added any value to this culture in any way?
....
....

....

....

....

12. What mitigation measures have been applied to avoid any dwindling socio-cultural and environmental aspects of household livelihood sustainability?

……………………………………………………………………………………………

……………………………………………………………………………………………

……………………………………………………………………………………………

………………………………………………………….....................

13. As a county leadership, what plans do you have for inclusive participation in mining? Please briefly explain

……………………………………………………………………………………………

……………………………………………………………………………………………

……………………………………………………………………………………………

……………………………………………………………………………………………

……………………………………………………………………………………………

……………………………………………………………………………………………

……………………………………………………………………………………………

………………………………………………………

Thank you

Appendix 3: Photos

At the farm

Getting ready with a respondent

Collecting data with mobile technology

Miners exiting a mining shaft

Ready for blasting

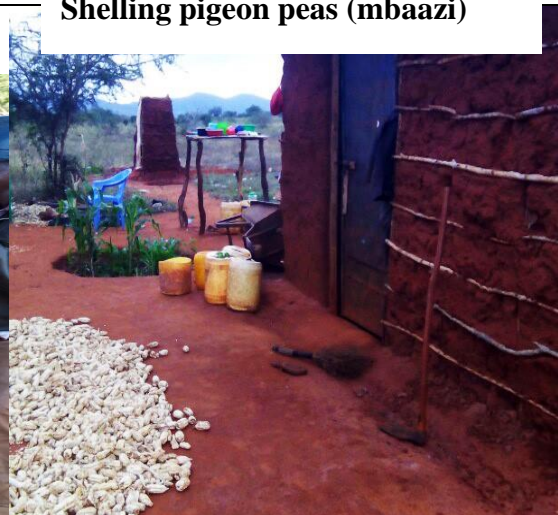

Surface Mining

shelling harvested maize

Shelling pigeon peas (mbaazi)

Talking to a respondent

Typical homestead activity

Water borehole

Shelling harvest

Appendix 4: letter from NACOSTI

NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

Telephone:+254-20-2213471,
2241349,3310571,2219420
Fax:+254-20-318245,318249
Email: dg@nacosti.go.ke
Website : www.nacosti.go.ke
When replying please quote

NACOSTI, Upper Kabete
Off Waiyaki Way
P.O. Box 30623-00100
NAIROBI-KENYA

Ref: No. **NACOSTI/P/18/96523/24258**

Date: **24th July, 2018**

Irene Wakio Mwakesi
University of Nairobi
P.O Box 30197-00100
NAIROBI.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on *"Mining and livelihood sustainability. A case study of Taita Taveta Kenya"* I am pleased to inform you that you have been authorized to undertake research in **Taita Taveta County** for the period ending **24th July, 2019.**

You are advised to report to **the County Commissioner and the County Director of Education, Taita Taveta County** before embarking on the research project.

Kindly note that, as an applicant who has been licensed under the Science, Technology and Innovation Act, 2013 to conduct research in Kenya, you shall deposit **a copy** of the final research report to the Commission within **one year** of completion. The soft copy of the same should be submitted through the Online Research Information System.

BONIFACE WANYAMA
FOR: DIRECTOR-GENERAL/CEO

Copy to:

The County Commissioner
Taita Taveta County.

The County Director of Education
Taita Taveta County.