

**IMPACT OF OPEN PIT ARTISANAL GOLD
MINING
A CASE STUDY OF RONGO CONSTITUENCY**

BY

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DECLARATION

I declare that this research study is my original work submitted as a requirement in partial fulfillment of the Bachelor’s degree in Environmental Planning and Management at Kenyatta University (Kenya). I declare that this work is submitted for the first time at this university/faculty and that it has never been submitted to any other university/faculty for the purpose of obtaining a degree. I hereby authorize copyright of this product to the University.

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MR. ALLAN KIRUI

DATE.....

DEDICATION

I dedicate this work to the memory of my father, Levite Mwango, my late brother, Raymond Ochieng and my mother, for her motherly and emotional support. You are always there for me, a pillar of strength indeed.

Abstract

This research explores the socio-ecological impacts in Rongo district caused by artisanal small scale gold mining. The International Labour Organisation (ILO) acknowledges gold mining by itinerant miners as the means of livelihood for more than 13 million people in the developing world. Although there are many potential socio-economic benefits of artisanal small scale gold mining, there are numerous negative impacts from these small and inefficient operations as a result of wasteful extraction and processing techniques. Environmentalists and disaster planners face the challenge of regulating the artisanal small scale mining sector to reduce the ecological impacts because of lack of resources since the country is on the verge of hyper inflationary environment. The escalating rate of unemployment is a force behind the increase of artisanal small scale miners, especially in Rongo district. Their unregulated activities in the district result in risk accumulation processes as it promotes land degradation, vegetation destruction, and pollution of water sources. This risk accumulation process if not checked as is the case in Rongo district will put an insurmountable pressure on the ecology resulting in its collapse in future. The unskilled and underequipped artisanal small scale gold miners use mercury for amalgamation as it requires no special skill and is inexpensive, fast and effective. The study used observational fieldwork, archival research, interviews and questionnaires. The research projects found that it was a ticking time bomb for an ecological disaster. The operations were found to be worsening environmental impacts. The negative effects are already being felt in the district as rampant land degradation has contributed to siltation of rivers Kuja and Migori among other variables, destruction of vegetation as well as contamination of water bodies. The impacts far outweigh the potential socio economic benefits of artisanal small scale mining. There is massive land clearing as by burning of bushes and unregulated stripping of the overburden. The role of the government as enforcers of laws and regulations and promoter of mining development need to be defined. Environmentally destructive mining practices persist as there is lack of enforcement and control mechanisms. On the other hand miners need to take responsibility for the negative impacts from their livelihood. They however need improved access to financial resources and more incentives for conservation.

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List of abbreviations

AIDS Acquired Immune Deficiency Syndrome

ASM Artisanal Small Scale Mining

Au Gold

CPWF Challenge Programme on Water and Food

EIA Environmental Impact Assessment

FAO Food and Agriculture Organisation

NEMA National Environment Management Authority

GDP Gross Domestic Product

HIV Human Immunodeficiency Virus

ILO International Labour Organisation

ISDR International Strategy for Reduction

MMSD Mining Minerals and Sustainable Development

NGO Nongovernmental Organisation

UNCED United Nations Commission on the Environment & Development

UNDP United Nations Development Programme

UNEP United Nations Environment Programme

EMCA...Environmental Management Coordination Act

1 CHAPTER 1

1.1 INTRODUCTION

1.1.1 Background of study

The research focuses on social and ecological problems caused by artisanal small scale (ASM) gold mining in Rongo district in Nyanza province Kenya. The definition of artisanal small scale mining varies from country to country (Africa, 2002). Variables like investment costs, mine output, labour productivity, and size of concessions, amount of resources, annual sales and levels of technology are used to define it (Lovitz, 2006:5). This research, however, defines artisanal small scale mining as an activity that encompasses small, medium, informal, legal and illegal miners who use rudimentary methods and processes to extract mineral resources. These miners are unskilled, underequipped and not knowledgeable and have little appreciation of the environment. For the purposes of this research, such mines are individual enterprises or small family owned companies not affiliated to multinational companies as well as gold panners. In this research there are instances where the term “gold panners” is used to refer to artisanal small scale miners.

Studies on the impacts of artisanal small scale gold mining have not been extensively carried out despite the fact that it employs more people than large scale mining. Numerous environmental and social impacts from artisanal small scale mining are gaining interest. Artisanal small scale gold mining in Rongo district has intensified due to rising poverty levels and perennial droughts that have been affecting the area over the past decade. The importance of artisanal small scale gold mining is reinforced by the fact that in the past few years it has become the main source of cash income in place of animal farming. Artisanal small scale gold mining therefore, serves as a source of livelihood and income as it has become the major source of cash income. Traditionally, people in Rongo district made their living from subsistence crop production and livestock rearing. In the recent past, households that relied on rain fed agriculture had continuously faced substantial food insecurity due to increased population thus pressure on land for settlement.

Diversification into artisanal small scale gold mining in Rongo district, while providing employment and livelihoods to many, poses ecological problems. The negative impacts of artisanal small scale gold mining in the district are deforestation, land degradation, deterioration

of water and air quality, depletion of water resources, loss of grazing land and the overall reduction in biodiversity. The nature of the mining activity promotes destruction of large tracts of land through, deforestation and land degradation. The practice has also become the worst enemy of water, air and the general biodiversity posing a threat to the ecosystem survival.

Environmental degradation has reduced the capacity of the ecosystem to meet the future needs of people for food and other products, and to protect them from flood and drought hazards. The degradation and loss of the ecosystem is capable of worsening negative impacts on human well-being such as reduced availability of goods and services to local communities, increased spread of diseases and reduced economic activity.

The gold panning process on the river banks, beds and the surrounding areas discharges huge amounts of loose silt and heavy metals into the river system. The research therefore seeks to investigate in depth the impacts of artisanal gold mining. A better understanding of the processes that lead to environmental problems can help promote environmentally friendly gold mining practices.

Soil and water quality are sensitive variables as they are the main drivers of ecosystems. These two are deemed to be victims of contamination and resultant pollution from highly toxic chemicals used in the processing of gold by the gold panners in Rongodistrict. To accomplish the concentration and amalgamation process gold panners use mercury. Mercury is a harmful substance to humans, animals and aquatic life, either indirectly or directly through bioaccumulation in the food chains (Tunhuma, 2006). Use of mercury in the extraction and processing of gold therefore is posing a threat to humans and aquatic life. According to the UNDP report (2005) mercury is a poisonous substance when either inhaled or washed away. It causes lung cancer and skin disease if inhaled and if washed away during the amalgamation process, it settles into the surrounding environment, where it is absorbed and processed by a variety of living organisms. Mercury used by panners is discharged in an abusive manner into ecosystems (Pfeiffer&Larceda, 1988; Meech, et al., 1998). UNDP in its report (2005:57) further notes that the amalgamation process transforms mercury into a highly toxic substance. It echoes that: “This process transforms elemental mercury into methyl mercury. Methyl mercury is one of the most toxic organic compounds and a powerful neurotoxin that works its way up the food chain through bioaccumulation”.

Kenya therefore, has not paid enough attention to the impact of mercury contamination as a result of artisanal gold mining activities. The reasons are partially because there is no state of the art equipment such as the “ultra – clean free – metal sampling protocol (Gill & Fitzgerald, 1985) to be used in carrying out studies to predict the potential impacts of mercury poisoning on humans and aquatic life. The use of mercury has polluted the water bodies and gold panning has contributed to the siltation of rivers and reservoirs resulting in reduced volume and quality of water a dam can hold.

Human beings, the key variable in perpetuating the degradation of ecosystems also suffer from their own creation. It has been noted that environmental health problems, especially from fire and unsafe mining operations, are on the increase. There have been deaths and injuries associated with artisanal gold mining in Rongo district. The immediate environmental health problems identified are injuries and deaths of humans as well as animals due to shaft collapse and excavations. There are also effects that are not immediate such as increased mortality as a result of respiratory and cardiovascular diseases. Poisoning of animals, both wildlife and domesticated ones, as well as humans caused by toxic concentrations of elements such as mercury.

The resultant scenario from artisanal small scale gold mining on the ecology of Rongo has been the fragmentation of ecosystems and habitats, obstructing migratory routes to breeding and feeding grounds used by wildlife and depletion of fisheries.

Artisanal small scale gold mining in Rongo district will, if conducted in an appropriate manner generate significant benefits. However, the poor health and safety record and use of environmentally destructive mining and processing practices have drawn much negativity and criticism to the sector (Noestaller, 1997). It is against this background that this research focuses on the level of the impact of ecological problems caused by artisanal small scale gold mining in the district. The research identifies and lists the ecological aspects being affected by artisanal small scale gold mining. It assesses artisanal small scale gold mining role on ecological risk accumulation processes that worsen disaster conditions. The research will also determine the nature and extent to which the ecosystem in Rongo district has been frayed by artisanal small scale gold mining thereby worsening the impacts of ecological disaster conditions.

This research provides an overview of artisanal small scale mining in general and its impact outlining the ecological problems, which include land degradation, loss of biodiversity, pollution, siltation and mercury poisoning. If these ecological problems remain uncontrolled they are likely to deteriorate into severe droughts, desertification, increased deaths and health problems which are already prevalent for example HIV and AIDS in Rongo district.

Secondly, it presents the methods; results and conclusions of the field research focusing on stakeholders' perspectives about ecological impacts. It is noted from the discussion that while impacts of artisanal small scale gold mining are a local problem, they have long lasting effects at a global scale and the costs are borne by other people outside this area. Therefore any policy formulation designed to promote artisanal small scale gold mining needs to take into account the long term impacts and render miners responsible for their downstream ecological effects. The research therefore concludes with the discussion of recommendations of what stakeholders may engage in to mitigate the negative impacts for the long term vision of sustainable artisanal small scale gold mining.

1.2 Definition of Terms

Ecology- Ecology is defined as the study of natural units that make up the environment called ecozones which are controlled by a set of common processes, mostly climate and are dominated by life forms with similar physical adaptations to these processes.

Ecosystems - Sudumeier-Rieux and Ash (2009) define ecosystems as dynamic complexes of plants, animals and other living communities and their non-living environment interacting as functional units (Millennium Ecosystem Assessment, 2005). They contend that ecosystems are the basis of all life and livelihoods, and are systems upon which major industries are based, for example, agriculture, fisheries, timber and other extractive industries. Sudumeier and Ash (2009) use the term sustainable ecosystems or healthy ecosystems implying that ecosystems are largely intact and functioning and that resource use or demand for ecosystem services does not exceed supply in consideration of future generations.

Biodiversity- According to Sudumeier-Rieux and Ash (2009), biodiversity is a combination of life forms and their interactions with one another and with the physical environment which has made earth habitable for people. In other terms ecosystems provide the basic necessities of life, offer protection from natural disasters and diseases and are the foundation for human culture (Millennium Ecosystem Assessment, 2005).

The given definitions clearly demonstrate the strong and varied links that exist between human wellbeing, human security, livelihoods, and health and intangible benefits with ecosystem services (Millennium Ecosystem Assessment, 2005). The Millennium Ecosystem Assessment, however, highlights ecosystem degradation as the main driver undermining the existing link due to a number of human activities mainly; overexploitation of resources like overfishing and unregulated artisanal mining activities, land use and land cover changes due to conversion to mining, croplands, urbanization and pollution from chemical waste, agricultural inputs and mining (Sudumeier-Rieux and Ash, 2009). The threat posed by artisanal gold panning to the existing link among the variables of the ecosystems in Rongo district will be discussed in the study.

1.3 Research Question

What is the impact of artisanal small scale gold mining on ecology in Rongo district?

What are the possible solutions to the impacts?

What is the current extent of the impacts on the environment and the people?

What are the benefits of artisanal small scale gold mining to the people of Rongo?

1.4 Aim of the study

To assess the contribution of artisanal and small scale gold mining on ecological damages in Rongo and the possible solutions to enhance sustainability

1.5 1.4 Objectives

1. To assess the impacts of artisanal small scale gold mining in Rongo district
2. To determine the socio-economic profile of the people of Rongo district.
3. To determine the nature and extent of ecological disasters associated with gold mining.
4. To establish the possible solutions to these impacts in order to promote sustainable management.

1.6 Research Premises

- There are several impacts of open pit mining to both the social wellbeing and the environment
- The government is not supportive on these mining activities
- Mining in the area has a potential to be a major economic benefit in the area if sustainable
- Rongo gold together with those from Migori contribute a good percentage of the total gold mined in the country

1.7 Justification of study

The study is timely and relevant as many Kenyan towns where open pit mining is carried out are facing critical challenges in terms of dangers posed on residents as well as lack of proper sustainable management of these mines. For a long time now, numerous disasters have been rising from different mines within the country, a trend that the government can easily control and eradicate completely.

For instance, the common case is always that of Macalda in Migori district where a lot of deaths are always reported resulting from collapsing shafts as well as other causes such as accidents of local residents falling into the pits. This is always a similar case in western province where gold mining is also common.

The choice of topic was thus prompted by such disasters and environmental degradation in order to come up with better solutions to curb such impacts and to make these activities more sustainable to the environment and the local communities as well as the national government.

1.8 Significance of the Study

In light of the calamities highlighted in the background statement, this research is important to the local community, government, policy makers and environmental managers in that it provides a step towards good land management practices that are crucial in sustainable resources (water, land, aquatic life forms – flora and fauna) management. Assessment of ecological disasters associated with gold panning is critical to decision-making, planning and implementation of development projects that are competing for the same resources in the district, for example rural, urban, legal mining, illegal gold mining, commercial and subsistence irrigated agriculture.

It also contributes to fundamentals of formalizing illegal gold mining and promoting community participation in policy making and environmental protection because it is the same community involved in these illicit activities. Community participation helps promote efforts that “advocate for cleaner production techniques to be used in the purification of gold to reduce impacts on gold panners and environment” (Ghose, 2003:169). Mabiza, van der Zaag, Manzungu and Ahlers (2002) argue that local communities should protect both surface water and groundwater from pollution, as they are interconnected and interdependent hence, it is important to couple surface and groundwater management within any water and management models. This study also exposes the impact of artisanal gold mining on water quality and quantity and therefore

contributes in forming the basis of studies on future modelling of the river basins in the district thereby leading to reduction in impending disasters.

The research raises awareness to the concerned society on the possible risks and hazards they are facing. Sound knowledge of the hazards and risks faced helps the community develop coping strategies that are relevant to specifications. In a nutshell, the research equips the communities involved and makes them more resilient to hazards hence, a resilient and disaster free community.

1.9 Scope of Study

The study covered two mines within the town that included Kitere mines and Sakwa mines that are located along river Kuja. The research endeavored to establish the impacts these mines have on the physical environment as well as the social lives of the people living around these mines and to come up with the possible solutions to these problems and challenges.

The data collection activities ran for a duration of two weeks between 10th of April to 23rd of April, where the information was obtained from various groups of people that included, gold miners, local community as well as given institutional heads whose activities were related to the mining activities either directly or indirectly

1.10 Limitations of Study

The following constraints were experienced during the data collection process.

- Insufficient/ inadequate time
- Financial constraints
- Lack of cooperation from suspicious miners and residents
-

2 CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter discusses the context of artisanal small scale gold mining as perceived in this research. The literature review has three distinct sections.

The first section focuses on challenges posed by gold panning to the environment including human and animal health, safety issues relating to chemicals used and collapse of shafts. Land degradation, soil erosion, gully formation, deforestation, air and water pollution are some of the problems facing both the formal and informal mining industry in the developing countries, and Kenya in particular.

The second section relates to issues facing artisanal mining in developing countries. These include all the problems affecting the miners and the industry as whole that hinder them from maximum utilization and sustainable management.

The last section deals with the artisanal mining case studies in different countries from global level down to regional and finally to local level. The section also includes possible solutions and models that can be applied to eradicate impacts of mining activities and to ensure that mining becomes a sustainable activity.

2.2 IMPACTS RELATED TO SMALL SCALE ARTISANAL MINING

(ASM) is rudimentary and highly migratory in nature. Kambani (2001) notes that from a structural and technical perspective, ASM is conducted on a very rudimentary level using basic tools such as picks and shovels. Ghose (2003:167) points out that it is because of their nature that these operations feature poor environmental management practices and safety conditions. Kambani (2001) argues that as a result the environmental degradation caused by ASM; it is growing with the intensification and growth of artisanal mining. This is further aggravated by the fact that institutions responsible for managing the environment are unable to effectively carry out regulatory and monitoring mandates due to lack of resources, which is the case with Rongo.

The practice results in physical environmental damage to rivers with consequent siltation of rivers, weirs and dams downstream. Some artisanal miners use mercury to recover gold resulting in contamination of river systems thereby posing danger of poisoning plant and animal life dependent on these river systems for survival.

2.2.1 PHYSICAL ENVIRONMENT

2.2.1.1 Economic Resources

The resources discussed in this section include trees, forests and minerals of economic importance. Trees are often cut down for firewood, building material, fencing and fuel leading to deforestation and subsequent land degradation (Hinton 2005) Illegal gold panning takes place majorly on river beds and on the adjacent river banks as well as on virgin land where gold reefs have been identified. The environmental impacts of the activity are always easily identified even though difficult to quantify. Although gold panning is deemed by many as a source of employment, a strategy seeking to cushion people livelihoods against such shocks as drought, the economic impacts are difficult to measure as most people engaged in the exercise are young men, women and children whose money is mainly spent in night clubs, and only little income is left for the households (Shoko, 2001).

2.2.1.2 Threats to Biodiversity

According to Shoko (2001) the following are environmental problems and their possible causes as a result of artisanal small scale mining and or gold panning in the Amazon basin. The set of problems caused by the clearing of land include soil erosion, siltation, and soil compaction, destruction of ecosystems and loss of biodiversity. Water pollution causes the destruction of aquatic ecosystems, plant life and depletion of fresh water resources. The third set of problems are those caused by air pollution and they are ozone depletion which protects short-wave radiation from the sun and global warming in which greenhouse gases trap long wave radiation thereby increasing the temperature on the earth's surface. Noise pollution from stamp mills, pan dishes and blasting also causes ill health, loss of hearing and migration of wild life and birds. Land degradation as well result in the loss of the landscape aesthetic value as mining activities leaves open pits and mounds of sand.

2.2.1.3 Vegetation Destruction

Dreschler (2001) argues that when the miners discover a lucrative area, they construct makeshift homes out of pole and dagga using local trees. Artisanal small scale gold miners are responsible for the clearing of extensive areas for fuel and infrastructural development in areas where those mines are located. This is as a result of the nomadic nature of artisanal small scale gold mining. The interesting point to note is that 100% of the miners' fuel needs come from wood. These rapid overnight settlements as observed by Shoko (2005) in newly discovered gold and gemstone areas does not only result in rampant deforestation, but also social ills associated with urbanization which include alcohol abuse, prostitution, land use conflicts with local communities as well as water pollution, child labour and diseases. He goes on to say that the excess reliance on wood as a source of energy results in the reduction of biodiversity and increasing rates of deforestation. Chiwawa (1993:25) estimates that for instance about four million tonnes of wood is used in Zimbabwe every year as fuel which translates to massive deforestation.

2.2.1.4 Land Degradation and Siltation

UNEP, (1999) refer to land degradation as a composite term defined as sustained loss in the quality and the productive capacity of the land. UNCED in the FAO discussion paper (2004) refers to desertification and land degradation as one. Land degradation threatens the economic and physical survival (UNEP, 1999) and leads to household and national food insecurity in many countries. A common indicator of land degradation is chiefly soil erosion among the reduction in vegetation cover and changes in vegetation composition. Artisanal Small scale miners occupy and utilize about 0.005% of total land in use (Dreschler, 2001), but they move a huge volume of about ten million tonnes of rock material per year. These figures show that the risk accumulation process as a result, is massive. Shoko (2005) argues that the environmental impacts of individual operations are not necessarily significant; the accumulated impacts of numerous artisanal small scale mining operations can create serious problems for ecosystems and local communities.

Dreschler (2001) argues that 80% of the operations are open casts or shallow pits less than 30m deep and there are left uncovered and unprotected. This kind of land disturbance resulting from gold panning activities leave a noticeable effect on the siltation of rivers and dams, deterioration of water quality, reduction of grazing land for animals and the overall reduction in biodiversity.

2.2.1.5 Depletion of Ground and Surface Waters

Shoko (2005) argues that absolute dependence on the use of large volumes of water dictates the location of mining operations close to water sources or right at the water source. Generally, research has indicated that artisanal gold mining puts a lot of strain on water as a resource. The activities of artisanal small scale mining in the Amazon basin as observed by Shoko (2005) have the potential to promote water pollution and depletion of both surface and natural underground sources as they are highly dependent on water. He further notes that the miners in the concerned district carry out their sieving and amalgamation process on the river bed and as such contribute to accelerated evaporation of surface water, drainage of wetlands and the siltation of rivers and dams. This has the overall net effect of promoting dry conditions as well as flooding respectively. For instance, Shoko (2005) points that frequent flooding of low-lying areas especially in Mozambique, South Africa and Zimbabwe has been attributed to the siltation of dams, rivers and lakes. Furthermore, Shoko, (2005) notes that ore and waste stockpiles established on surface has a negative impact on the environment. These contain significant amounts of sulphides and, with the passage of time, heavy metals, sulphates and other pollutants are dissolved and leached out by precipitation into local streams and community water sources. The impact of mineral pollution on an ecosystem may be severe and may result in the total elimination of animal life from the receiving waters. There has also been an emergency of invasive alien species on the stockpiles. According to Dreschler (2001) artisanal small scale gold mining is associated with mushrooming of unplanned squatter camps located close to water courses with poor or no sanitary facilities. This development has high chances of considerable amount of water pollution from human waste.

2.2.1.6 Soil Erosion

Closely linked with vegetation destruction and land degradation is the case of soil erosion. Gold panners as argued by Dreschler (2001) move an average of eight million tonnes of material for panning per year, and this ends up in the streams and dams as silt.

2.2.1.7 Dust and Noise

Dreschler (2001) in his study finds that the widespread use of pestle and mortar generates fine quartz dust, which is inhaled by those involved (mostly women) in the process. The dust and fumes generated by blasting are quickly diluted and dispersed as most operations are shallow workings. He also notes that noise, dust and blasting vibrations produced in artisanal small scale mining operations are by no means comparable to that produced in large scale mining operations which are a common feature in large scale mines. In artisanal small scale mines these are almost non-existent. The miners access explosives through illegal means as they should be kept in safe places.

2.2.2 SOCIAL AND HEALTH IMPACTS

2.2.2.1 Mercury Poisoning, Health and Safety

The use of mercury in the amalgamation process of gold pollutes water and ecosystems. Dreschler (2001) argues that the main pollutants are mercury and cyanide, and to some extent human excrete because of lack of sanitation facilities. Shoko (2005) observes that in alluvial gold panning operations, mineral concentration is conducted “by the use of gravity separation through the medium of water” using panning dishes and sluice boxes. In a study by Mpendazoe (1996:110) in Tanzania, established that 78% of water samples tested in the Lake Victoria Goldfields contained mercury in concentrations high above the drinking water standard of 1g/l. This scenario is believed to be similar in countries like Zambia, Zimbabwe and Mozambique since use of mercury by artisanal small scale mining is extensive as well. Donkor (2006:3) argues that mercury is poisonous to humans and aquatic based food chains through bioaccumulation. Dreschler (2001) notes that the use of mercury in Zimbabwe is widespread, effective, simple and cheap with as much as up to 2g per gram of gold (Au) recovered. It is used with the view that the more the mercury used the more Au is recovered.

2.2.2.2 Drug Abuse

It has been found out that drug abuse is rampant among illegal small-scale miners, who believe that drugs can help them work harder (Adu-Yeboah et al, 2008). The commonest drug in the study area has been ‘marijuana’

2.2.2.3 Prostitution

According to Dogbe (1995), there are two main types of sex workers. These are mobile sex workers and resident sex workers. The resident ones service the local gold mine operators and the low ranking workers employed by the companies. These ones target the expatriate workers, high ranking officials in the companies and those they refer to as “buyers” who come to buy gold from the local operators.

Adu-Yeboah et al, (2008) stated that young women and girls migrate to mining areas with the intention of trading or to find jobs, and when they are unsuccessful they resort to prostitution which they claim is more lucrative than the trading. This has resulted in an increase in HIV/AIDs cases in the area.

2.2.2.4 Land Use Conflict

According to Zo (1997), the coming of surface mining in an area does not only abuse the human rights of the indigenous people but also brings different problems about land use. The mining companies have large tracts of land for their operations and farming is not allowed in their concession areas unless authorized by the companies. Even if permission is granted, the farmers are allowed to grow seasonal crops such as cassava, maize, vegetables. It is noted that mining activities both large and small share space with agriculture, timber and other activities.

2.2.2.5 Child Labour

Most artisanal mining in the developing countries involve young children who are either working with other members of their family or others who just go there to sustain their own livelihoods like the orphans. This factor leads to many children dropping out of school and others failing to attend school completely from childhood

2.3 CHALLENGES FACING ARTISANAL GOLD MINING

2.3.1 Vulnerability

ASM is frequently driven by vulnerability, offering a (often short-term) coping mechanism for poverty. Vulnerability is a person's (or group's) particular characteristics or situation that influences their ability to anticipate and overcome shocks and hazards (Wisner 2004). People are vulnerable when they have limited ability to overcome unpredictable crises and shocks such as floods, drought, sickness, environmental degradation and worsening terms of trade (URT 2004:19). Poor people are especially vulnerable, as they have few buffers or resources to cope with hazards or shocks. Understanding poverty reduction requires an understanding of vulnerability (IDS 2012).

For example, gold mining is no longer just a boom and bust activity, but one driven by the inherent vulnerabilities of poverty (although there are some who continue to be driven by opportunism). Gold is currency for people who are unable to participate in the cash economy. Its high margins and low barriers to entry make it a highly lucrative activity for those with little human, physical and financial capital. ASM can thus provide a relief to vulnerability, particularly where resources are invested wisely.

2.3.2 Marginalisation

The Hivos–IIED Knowledge Programme on small producer agency describes 'small-scale farmers' by their degree of marginalization rather than the size of their land or scale (Murphy 2010) — recognizing that size does not always equate to prosperity. The same approach can be applied to artisanal and small-scale miners, regardless of their exact size, level of mechanization, etc.

ASM faces the same marginalisation as other 'small-scale' sectors. Many miners operate in remote regions with poor transport and market access, suffering geographical marginalisation that makes them less able to access information, key technologies and inputs. It also leads to political marginalisation, as communities far from the capital or 'centre' are less able to influence policy and keep 'in sight of' policymakers.

Small-scale producers may be marginalised in terms of access to markets — forced to sell through informal, illegal or less lucrative channels. Marginalisation is often linked to food insecurity. Concern International defines marginalised farmers as 'farming yet hungry' (Murphy 2010). The same approach can be applied to ASM — 'mining yet hungry' — meaning the miners have insufficient assets or income to purchase adequate food for themselves or their dependents.

2.3.3 Informality

Informality here refers to operating without an applicable or appropriate legal framework. It was once considered synonymous with subsistence activities that offer no real opportunity for economic development. More recently, interpretations have become more nuanced. Informality can represent innovation and dynamism, and can offer poor producers and accessible route into economic activity (De Soto 2002; Hart 2006). However, it can also exacerbate problems of marginalization and vulnerability. Informality marginalizes a community politically, economically and even socially. Informality can both increase resilience by providing an economic livelihood activity and increase vulnerability as it removes the protections and opportunities provided by the government.

ASM is informal, but miners are not alone. Many small-scale producers in natural resources sectors operate informally and often this is the norm. In Bolivia, for example, people use the term ‘popular economy’ or ‘people’s economy’ (Hivos 2012a). This resonates with the ILO’s (1972) definition of informality as a ‘way of doing things’ defined by:

- low entry barriers to entrepreneurship in terms of skills and capital requirements;
- family ownership of enterprises
- small scale of operation
- intensive production with outdated technology
- Unregulated and competitive markets.

Often, informality dominates because of formidable obstacles to formalization. These processes tend to be overly complicated and bureaucratic, centrally determined and managed, reliant on the state for regulation, and lacking social relevance. This is both symptomatic of and exacerbates geographic, political and social marginalization. Informal systems often have rules and processes based on years of social and cultural tradition. Regulation is through cultural norms and social contracts — a form of ‘legal pluralism’ in which traditional, informal and formal rules overlap and operate simultaneously (Clever 2000).

2.3.4 Inherent Structural Challenges

The structural dynamics of the ASM sector are poorly understood. Despite significant documentation of ASM’s environmental and socio-economic impacts there ‘continues to be very little baseline information on how operators and activities are organized’ (Hilson 2012:184). ASM sector is often perceived, understood and approached as — the ‘problem framing’ — and within which certain trends begin to emerge that reveal what marginalization, vulnerability and informality mean for ASM. These include:

- Weak legislation, policies and implementation and often government marginalisation or repression (favouring LSM at the expense of ASM);
- Cultural marginalisation and exclusion of certain demographic groups;
- Low barriers to entry into informal or illegal ASM with its poor social and environmental protections;
- Lack of legal protection for land and resource rights;
- Poverty-driven, short-term decision making;
- Uncontrolled migration;
- Poor access to financial services, market information, technology and geological data;
- Political exclusion (meaning miners are often excluded from decision making at various levels) and ‘policy blindness’;
- Lack of baseline/census data on ASM individuals and communities; and
- Reliance on mining in ASM communities due to vulnerability and marginalisation.

Structural challenges can vary dramatically by region or geography. For example, child labour in ASM varies between Latin America, Asia and Africa (ILO 2005:4–5). In Latin America, where ASM has a long history, children’s involvement is part of that long tradition. In Asia, the private sector’s involvement in ASM means there is less child labour. In South Asia the traditional stratifications of society means child labour is often seen alongside social marginalisation. And in Africa, where ASM is associated with civil war and conflict, weak government and social institutions means children are forced into mining through need

2.4 CASE STUDY

ANALYSIS OF FORMALIZATION APPROACHES IN THE ARTISANAL SMALL-SCALE GOLD MINING SECTOR

TANZANIA CASE STUDY

Over the past three decades, the artisanal and small-scale gold mining (ASGM) sector in Tanzania has been increasingly important for poverty alleviation nationally. Tanzania, Africa's fourth largest producer of gold (after South Africa, Ghana, and Mali), is experiencing a boom in its mining industry. ASGM activities, taking place in many regions of the country, play a significant role both as a direct source of employment in mining communities and in generating additional jobs and revenues in the rural economy. Tanzania's mainly informal ASGM sector began to grow in the 1980s. The downturn in the performance of other productive industries, poor markets for agriculture, droughts, and other factors have been associated with the increase in the number of people working in ASGM in the 1980s and 1990s. A report by one of Tanzania's regional small-scale mining associations notes: "The closure of state-owned mines in the 1980s and privately owned mines in Tanzania in the early 1960s forced semi-skilled people to opt for artisanal mining. Another factor is that from 1970 to 1990, the government had long and complicated processes for granting mineral rights to applicants [increasing] the number of informal artisanal miners. In the 1990s, when large tracts of land were allocated to large companies as part of a national economic reform process, many farmers became reliant on artisanal mining. The rise in gold prices globally has been a factor in attracting people into the ASGM sector, but researchers widely recognize that most ASGM in Tanzania is driven fundamentally by critically limited livelihood options. Diverse types of mineral extraction are important in Tanzania's artisanal and small-scale mining sector. Operations range from semi-mechanized and mechanized mining to the extraction of minerals using simple technologies with little or no economic capital and no mechanization. It is emphasized in studies that ASGM should be accorded careful regulatory attention, to address different types of mining operations and to ensure and improve their contribution to poverty alleviation and rural development. These activities involve gold production from both alluvial deposits and hard rock mining, and gold rushes have taken place in multiple regions of the country, especially in the area near Lake Victoria in the North.

Estimates of the number of artisanal and small-scale miners in Tanzania range from 500,000 to 1.5 million the government has estimated that small-scale mining generates at least three jobs for each individual directly involved. Gold and gemstones are the most widely extracted minerals by artisanal and small-scale miners, and the artisanal diamond mining sector has also been growing in recent years. National gold exports reached US \$1.076 billion in 2009, up from US \$932.4 million the previous year – including all large, medium, and small-scale mining operations. Artisanal and small-scale gold mining may account for approximately 10% of Tanzanian gold production, though most of the small-scale mining activities are currently informal (i.e., not licensed officially).

The 1979 Mining Act created opportunities for small-scale mining by allowing mining permits in areas designated for mineral prospecting that did not require large expenditures and specialized equipment. In the late 1980s, the government began to support new opportunities for small-scale mining communities when it ended the monopoly of the State Mining Company and began liberalizing the mining and selling of gold. The government's Small-Scale Mining Policy Paper of 1983 encouraged citizens to supplement their incomes by participating in mining activities. In the 1990s, the government developed a legal and policy framework for formally integrating small-scale mining into a national mineral development strategy, introducing the Tanzanian Mining Policy of 1997 and the Mining Act of 1998, components of a mining policy reform process that was supported by the World Bank. Among other policy aims, the reforms included the aim of legalizing and formalizing the small-scale mining sector by establishing a suite of basic environmental and safety standards for ASGM along with a new permitting system. At the same time it passed the 1998 Mining Act, though, the government prioritized the development of large and medium-scale mining as an economic strategy, leading to many large tracts of land being allocated to larger companies. Since then, a number of public debates have emerged on Tanzanian mining policy, highlighting a need for allocating land for artisanal and small-scale mining activities specifically and making the licensing system more equitable and accessible to marginalized groups. Although national poverty reduction papers in the early 2000s overlooked artisanal mining, by 2005 they began to emphasize that, "the livelihoods of artisanal miners need to be balanced with commercial The Ministry of Energy and Minerals formulated strategies aimed at developing small-scale mining, initiating measures for improving information and statistics on ASGM, and developing extension services aimed at assisting miners to improve

technologies. Government policy papers recognized that detailed knowledge of dynamics in mining communities is vital to regulate extraction activities effectively, and the official government policy objectives have been to promote small-scale mining cooperatives, to support the improvement of equipment in small-scale mining, to encourage partnerships between small-scale miners and companies, and to deliver assistance to mineworkers through technical training at selected sites. Responding to a number of concerns about mining laws, the President of Tanzania commissioned a high-level review of mining legislation and policies in 2008, led by the Bomani Presidential Mining Sector Review Committee. The findings of the Bomani Review Committee emphasized the need to amend the mining legal framework and associated mining policies, particularly so that Tanzanian citizens have greater opportunities to benefit from and participate in the mining sector. This led to a new Mining Law being passed in 2010. The analysis in Table 1 highlights four key evolving areas of national policy and how they generate shifting sets of possibilities and lessons for formalizing ASGM activities. The diversity of ASGM activities presents a complex set of challenges and opportunities. Many perspectives exist when it comes to understanding what artisanal and small-scale mining entails and which issues should be prioritized in Tanzanian regulatory strategies. Studies emphasize the contribution this sector can make to poverty alleviation in Tanzania, but they also note that problems of labour exploitation, smuggling, and land use conflicts need to be addressed in policy measures to license and regulate miners. Mercury amalgamation, a simple and inexpensive way to extract gold, is the most commonly used method, thus ASGM also poses significant environmental and health risks arising from mercury use.

The Government of Tanzania learned key lessons by collaborating with development institutions, researchers, and civil society organizations to address ASGM practices. Some pilot programs generated important benefits, particularly in minimizing mercury use and developing local capacities for upgrading technologies and reducing health risks. In 2006, the government partnered with the United Nations Industrial Development Organization (UNIDO) to develop a “Manual for Training Artisanal Miners and create training programs in selected ASGM communities in Geita District. The initiative involved a “train-the-trainer” exercise in which a team of local mining engineers, nurses, environmental management specialists, and others worked together to implement a program of capacity-building at selected sites.

2.5 RECOMMENDED ACTION PLANS FOR SUSTAINABLE MANAGEMENT AND DEVELOPMENT

2.5.1 INTRODUCTION

For many centuries the small scale mining of precious minerals has made a significant impact on the socio-economic as well as environmental situations of people and communities involved directly or indirectly in the sector (Kesse. 1985;Hilson,2002)

Sustainable development of minerals and other natural resources has been endorsed as a global management and development strategy environmental, economic and social developments have been highlighted as the three pillars of sustainable development and their integration is encouraged (WCED. 1987; Anon, 1992)

There are however several arguments about the applicability of these concepts in the mineral industry, especially the small scale mineral industry, since minerals are non-renewable resources that are subject to exhaustion in the course of production. The exhaustible nature of these resources places a limit on growth of these industries and hence heir sustainability (Lele 1991; Mikesell, 1994: Traore, 1997;Ednie, 2002, Anon 2002)

In Ghana for instance there is an ongoing discussion by the stakeholders in the mining industry on measures to mitigate the negative effects of small scale gold mining and to help the industry develop in a sustainable manner (Yakubu, 2002; Hilson 2002)

2.5.2 THEORETICAL FRAMEWORK

COMMUNITY PARTICIPATION THEORY

Community Participation theory involves five main principles or premises that involve: Top- down management approaches, mobilization of human capital and resources, community knowledge of problems and their solutions, capacity development and involvement of affected communities (Botterill and Fisher, 2002: 2-3). This is done to make the discussion more focused and ensure a flow of analysis as outlined by the framework.

2.5.2.1 Top Down Management of Impacts

In the literature, the term „top-down approach“ has been defined variously. However, I choose to define the term as the an approach to management in which decisions are determined and made by top officials of government, institutions and experts without direct grassroots involvement and participation in the decision- making process. One major characteristic of most development projects is the tendency for these projects to be developed and initiated by so called experts and technocrats and then imposed on the people for whom they were meant without their participation and involvement in the determination, design and implementation of the projects. Being aware of the major social and environmental impacts that their mining activities is having on the people of Rongo, the companies have to take steps to manage and deal with such impacts on the people to ensure that the people live normal lives. However, the extent to which the community is involved or participates in the development of these impact management strategies is of much concern to this research. The Community Participation Model notes that „top down“ approaches usually fail to resolve many problems for which they are designed and hence advocates for a much more „bottom up“ approaches to solving problems. The aim is to ensure the sustainability

2.5.2.2 Mobilization of Human Capital and Resources: Coping with Mining Impacts

Adam Smith defined human capital or human resources as “the acquired and useful abilities of all the inhabitants or members of the society. The acquisition of such talents, by the maintenance of the acquirer during his education, study, or apprenticeship, always costs a real expense, which is a capital fixed and realized, as it were, in his person” (Smith, 1776 cited in Chen et al, 2007). By extension, all people wherever they are, have very vital abilities and capacities that can be harnessed effectively to bring about required levels of development in the community or society whether it was acquired through education or imbibed in the very person by virtue of his birth or existence. At the very basic level, the people of Rongo have to take giant steps in managing the impacts that mining has unleashed on them in the community. Most people in the community have naturally developed their own coping and survival mechanisms in response to the impacts that mining is having on their lives in order to survive. Solely individual households and residents developed these mechanisms themselves without the help of any external body. For most residents, coping with or managing major social impacts such as crime and conflict, prostitution, escalating prices of goods, services and food commodities, and the lack of infrastructure does not lie within their capabilities. This is because to them they lack the technical and expert capacities to manage and deal with such impacts. In terms of social impacts, employment is the only impact that the people have naturally developed their own way of managing the unemployment situation.

One major principle that underlines the community participation model is to see the community as partners in development and not passive recipients of development. In fact, community engagement and

social license are mutually reinforcing and parallel processes that occur both as cause and consequence of addressing and managing social and economic impacts at the community level” (Institute of Social and Ethical Accountability, 2004: 22).

2.5.2.3 Community Knowledge of Problems and their Solutions

Community Knowledge has been defined as “the vast and vague information that communities possess which enables them to interpret the everyday world and also identify a menu of possibilities for asserting and responding to our own needs and aspirations and the needs and aspirations of others” (Lopez, 2004: 70). This by implication is that the community residents are the very people who own their problems and it is the same people who have the best solutions to them among the very many possible alternatives for solving the problems. Therefore, development initiative or programmes cannot be developed with them in isolation. This is the situation in Rongo because the people demonstrate great deal of knowledge about the problems that they are facing individually and collectively as community members and would also give various measures that could be implemented to manage and solve these problems especially those that are the direct and indirect result of the mining activities.

2.5.2.4 Capacity Development

Developing the capacities of people is one major and surest way to help people to manage and deal with major development problems and is adequately espoused by the Community Participation Model by Botterill and Fisher. This is because it would better equip people with the skills and abilities to deal with problems on their own without dependence on external help.

Capacity Development is “the process by which individuals groups, organizations, institutions and societies increase their abilities: to perform functions solve problems and achieve objectives; to understand and deal with their development need in a broader context and in a sustainable manner” (UNDP, 1997 cited in Lusthaus et al, 1999: 3).

The management of mining impacts would be very sustainable and achieve the desired results if the capacities of the people who are impacted are adequately developed to manage the impacts. The people of Rongo undoubtedly understand their problems best and know their solutions. However, what is most needed is the necessarily capacity to sustain such solutions developed to manage the impacts. For most social problems, people lack adequate technical and logistical capacities to deal with them even though

they have ideas about possible solutions. However, community residents can deal with the major social and environmental problems if they are adequately developed and empowered to do so. This development takes the form of training people with the requisite skills and technical abilities in dealing and managing

impacts as well as the provision of logistics and facilities that will sustain that effort

2.5.3 CONCEPTUAL FRAMEWORK

Conceptually, I represent this model below:

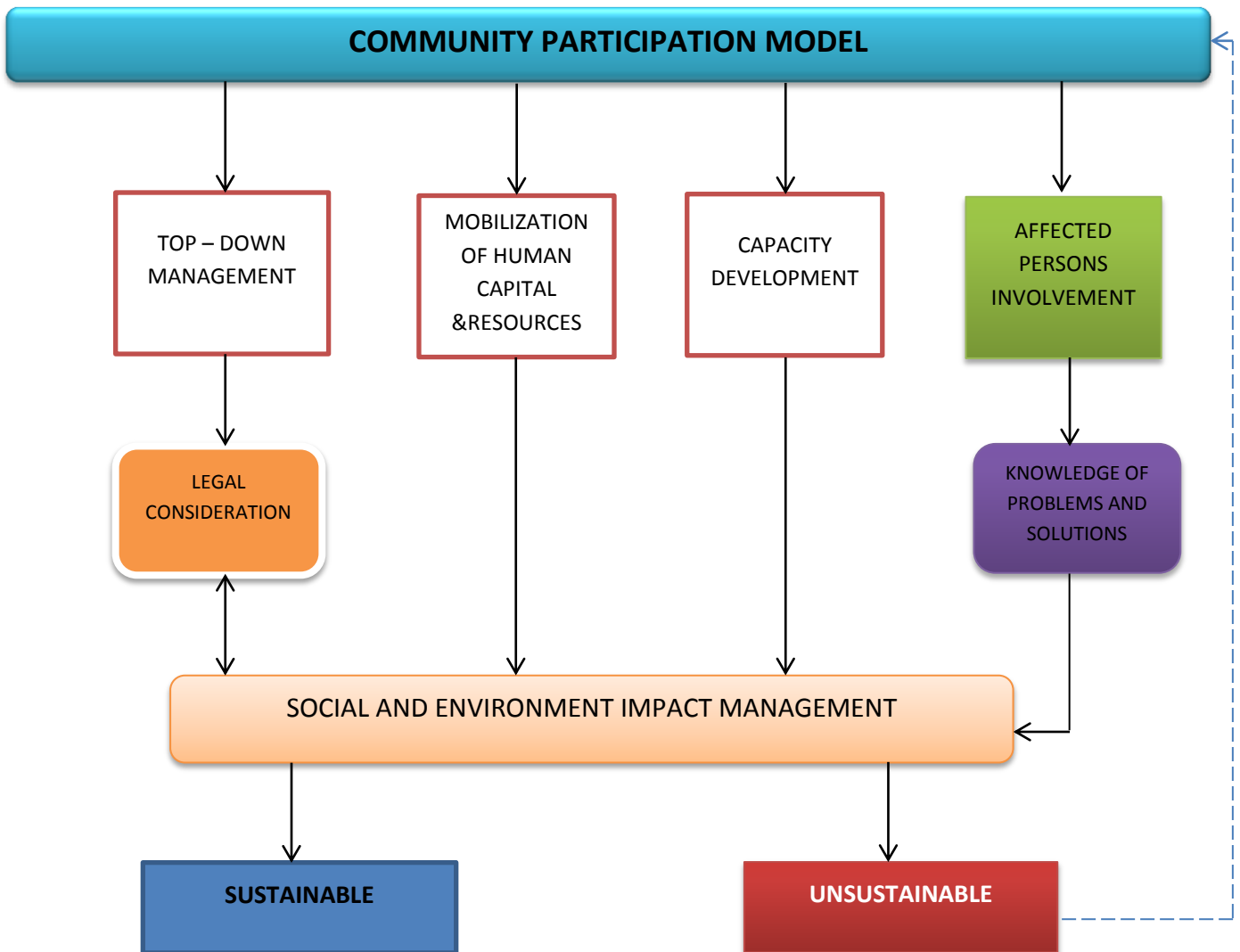


Figure 2.1 Community Participation Model

According to the Botterill and Fisher, the application of the model to the Australian Landcare Programme, Coastcare, Dunecare and the Fisheries Action Program has been very successful and has been implemented in many European Commission and Commonwealth countries (Botterill and Fisher, 2002: 5-6). I therefore intend to apply this model and its basic premises to the mining situation in Rongo and how its application could help to achieve the sustainability of Impact Management Strategies in the community as developed by the mining companies in Rongo. Particularly of much importance would be to discuss and assess the findings of the research on the extent to which the community is involved by companies in the management of the social and environmental impacts of their mining activities. Attention would be placed on how the community as a whole is involved in the design and implementation of various impact management strategies and measures and the mechanism for community involvement. The nature of existing impact management strategies would be assessed and their level of community participation would be discussed. From the conceptual framework above, the belief is that the active participation of the community in managing the impacts of mining is an effective means and mechanism in ensuring the sustainability of impact management strategies and various development programmes introduced by mining companies and also helping the people to adjust to the impacts. The community is hence, regarded as partners with the mining companies in managing the impacts of mining in the community because they are seen as also possessing certain capacities and resources that could be utilized by the companies who also possess certain capacities that the community lacks. The amalgamation of these capacities and resources from both the community and the companies is essential in securing the commitment of the community in ensuring the sustainability of impact management strategies.

3 CHAPTER 3

AREA OF STUDY

3.1 INTRODUCTION

Rongo is one of the Districts in Nyanza province located in Migori County. The town measures 208.40 km² with a last census population of 79,885 in 1999 and 100,547 in 2009 and a population density of 376. It is located at 0⁰46'11''S x 34⁰36'0''E and a latitude of -0.77000 and longitude of 34.60000.

The closest towns to Rongo include Homabay 32.4km NW, Awendo 28.8km SW, Kisii 21.0km NE and Oyugis 32.8km NE.

The town is located along Kisii to Migori Highway. It is the junction to Homa Bay Town and also junction to Ogembo and Kilgoris towns in Gucha District. It is a very busy place with lots of social and economic activities from Farming, Shops, Offices,

Hospital, BAT leaf Center, Kuja School for the Deaf, Catholic Pastoral Center, Police Station and many good schools around it.

3.2 CLIMATE AND PHYSICAL FEATURES

The altitude varies between 1140 to 1600 m above sea level and 1700 meters with several undulating hills and plains. The valley is generally flat and has potential for Agriculture and development if adequate water is provided. Rainfall patterns in the region vary ranging from 700mm to 1800 mm annually with the short rains occurring between March and May, while the long rains fall during the October to December period. While the annual vegetation is mainly deciduous and (planted/artificial) forest on gazette and individual hills while the rest of the region is covered by savannah grassland. It has one permanent river, Kuja and Migori.

3.3 DRAINAGE

The area is relatively flat with surface waters existing in the form of rivers, Migori and Kuja. It also has small streams in various parts especially in valleys where two hills join. There is adequate potential for tapping ground water for use in industrial plants in the future as well as possibility of directly accessing water from perennial rivers. Perennial springs are found within

the district they are good water sources but may be contaminated. Many are now being protected under various GOK and NGO programmes.

3.4 GEOLOGY AND SOIL

The rocks of the Rongo district are Archaean in age, about 2.8 billion years old. They are referred to as the Migori granite-greenstone complex. The Archaean rocks of the Rongo district are known to contain gold. Gold occurs in quartz veins within the mafic volcanics of the Nyanzian Group. The host rocks are metabasalt, banded ironstone, shales and andesites. The auriferous quartz veins have a general trend of 320° and a dip of between 65° and 90° to the southwest.

3.5 TRANSPORT AND INFRASTRUCTURE

The town has one major highway along Kisii to Migori Highway. It has another road, the junction to Homa Bay Town and also another junction to Ogembo and Kilgoris towns in Gucha District. It has a weigh bridge that is used to measure the weights of big trucks and trailers. The main mode of transportation is road. The town has major buildings that house banks, hotels and organizations. There are various sources of energy in the district, which include fossil fuel, wood fuel, solar energy and hydroelectric power.

3.6 POPULATION PROFILE AND PROJECTIONS

The town measures 208.40 km². The previous national census before the latest was carried out in 1999 and Rongo's population was 79,885. The last census was carried out in 2009 and the population was at 100,547 with a population density of 376.

3.7 SOCIO-ECONOMIC CHARACTERISTICS

Rongo district is a multi-ethnic district with an average population density of 376 persons per km² including tribes; Luo, lughyia, Kuria, Kisii among other small tribes.

The main economic activities in this district include agriculture, livestock keeping, mining, fishing trade and commerce, transport and communication.

Agriculture contributes to 69% of the household income in the region and provides major employment to the rural population. Most of the activities are undertaken by small holder farmers with farm holdings ranging from 2-4 ha. The main food crops grown include maize,

sorghum, finger millet, beans, cowpeas, green grams, sweet potatoes, cassava, and horticultural crops mainly kales, onions and tomatoes while the cash crops grown are sugarcane, tobacco and sunflower.

The Second Poverty Report reported that 58% of Migori District's population lives in absolute poverty Rongo being one of the constituents. The report identifies the main factors that could be giving rise to poverty in the district as being population growth, economic and environmental factors, HIV/AIDS menace and socio-cultural practices and attitudes (e.g. polygamy and wife inheritance). Inadequate and unreliable rainfall patterns have immensely affected agricultural in some parts of the district.

Map of driving directions from Migori, Kenya to Nairobi, Kenya

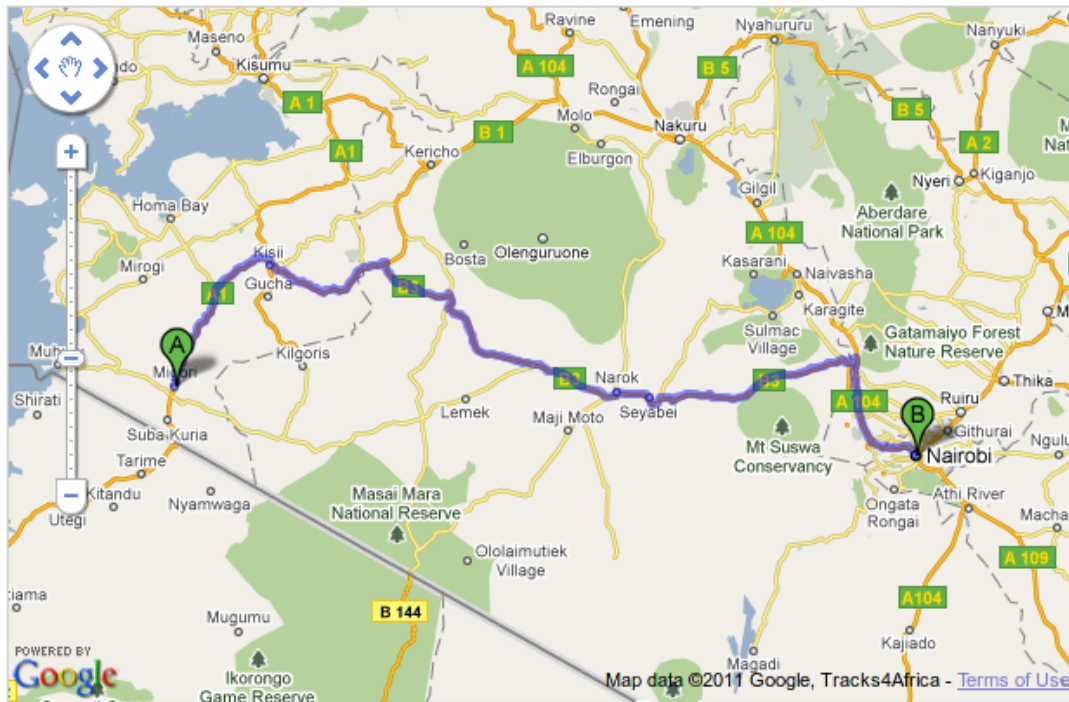


Plate 3.1: Map of Rongo town

4 CHAPTER 4

RESEARCH METHODOLOGY

4.1 INTRODUCTION

This chapter discusses methods and procedures used to collect data. The research study was based largely on qualitative data and relied on document review, interviews and observations for data. Primary data was collected mainly through observation, open ended questionnaires and interviews. The interviews were held with gold panners, household heads, local leaders (chiefs and village heads) municipal authorities, various ministerial departments and relevant non-governmental organizations. It was then supplemented by use of questionnaires which were distributed to selected members. Secondary data was obtained by reviewing existing literature. Information from published sources, local statistics kept in various departments, various websites and unpublished sources were used as well. Interviews were earmarked for such data on the number of people trapped in shaft collapse, vegetation disturbed, land destroyed and aquatic life.

Interviews with the locals were also held as they are in close contact with the reservoirs almost on a daily basis. People engaged in the fishing business were contacted through interviews as their business has been affected. Measuring of siltation in rivers and dams for the research was difficult as there are many variables contributing to it such as agricultural activities like irrigation and animals (both wildlife and domesticated), erosion, deforestation and gold panning itself. To measure and quantify the amount of silt from artisanal small scale gold mining for this project was somehow an insurmountable task.

Field visits and observations on the silted river systems were carried out. Pictures of derelict land were captured. Degraded land was also photographed where panning occurs for analysis. To measure the loss of land area and the amount of vegetation cover, the researcher gave an approximate quantification in terms of land area cleared by artisanal small scale miners.

4.2 Research Methodology Definition

Research methodology, according to Miller (1979) refers to the planned sequence of the process involved in conducting the research.

There are two broad categories of the investigation process that is the quantitative and the qualitative research (Matveev, 2002). The variety of data collection techniques used around the world fall under these categories (Oatey, 1999). Quantitative research employs numerical indicators to ascertain the relative size of a particular phenomenon under investigation while qualitative research on the other hand employs symbols and words to indicate the presence or absence of phenomenon (Matveen, 2002). This research is highly qualitative in that there is need of an interpretive paradigm based on the ecosystems interactions or interconnections existing in Rongo district. People are a part of the ecosystem interactions and thus a social reality must be created and sustained through the subjective experiences of people involved in these interactions (Morgan, 1980). It is therefore for this reason that the researcher is instrumental and plays an active role in the data collection, (Wimmer and Dominick 1997:84)

4.3 Research Design and Research Instruments

The term research design in this study referred to the basic plan or strategy of research, the logic behind it which made it possible and valid to draw conclusions (Oppenheim, 1992:6). The study adopted purely a qualitative approach that suits well a case study. Quantitative aspects were however used through the administration of questionnaires to collect data on aspects like the size of cleared land and the area size disturbed by artisanal small scale gold miners since they are responsible for clearing extensive areas of natural bushes for firewood and infrastructural developments. The quantities of moved tonnes of ore and waste were obtained from the artisanal small scale miners. This was used to broaden the scope of data collected. The strengths of a qualitative approach as noted by Hitchcock and Huggers (1995:12) are that it allows the researcher to learn at hand, about the social world being investigated by means of involvement and participation in that world through a focus upon what individual actors are involved in.

4.3.1 Qualitative Research

Qualitative methodology was the major research design of focus in this study as it provided the much needed depth of the data. The method is concerned with attempting to accurately describe, decode and interpret the meanings of phenomena occurring in their normal social contexts (Fryer, 1991, Matveev, 2002).

It is an interpretive paradigm focused on investigating the complexity, authenticity, contextualization, shared subjectivity of the researcher and the researched and minimization of illusion (Fryer, 1991). The approach assists the researcher to regenerate rich, detailed data that leave the participants perspectives intact and provide a context for health behaviour.

Qualitative research in the interest of this study allowed for obtaining more in-depth information about such phenomena as people's beliefs, attitudes and behaviour towards artisanal small scale gold mining as it occurs in its natural setting in Rongo district. The qualitative approach helped in the comprehension of meanings people assign to phenomena and elucidating the mental processes underlying behaviours. In support of this viewpoint, Denzin, (1971); Lincoln and Guba, (1985); Marshall and Rossman, (1989) contend that qualitative research is more likely to take place in a natural setting meaning that focus is on everyday activities as defined, enacted, smoothed and made problematic by people going about their normal routines, (Van Maanen, 1983: 255 & Matveev, 2002). Ting-Toomey, (1984) names three characteristics of qualitative inquiry and these are firstly, the study of symbolic discourse consisting of texts and conversations, the study of the interpretive principles that people use to make sense of their symbolic activities and lastly, the study of contextual principles such as the roles of the participants, the physical setting and a set of situational events that guide the interpretation of discourse (Matveev, 2002). It was for these issues that qualitative research was more relevant in this study because the focus is on the natural ecosystems of the Rongo District.

Interview was the most ideal form of investigating sensitive information that most people were not willing to disclose. The target population were elusive and not willing to give such information as those dealing with legality, mine ownership, damages caused and thus interviews were deemed the best research tool as they allowed getting into the bottom of the matter. In support (FAO, 1997) argues that depth interviews are particularly effective where the study involves an investigation of complex behaviour or decision-making processes; when the target

respondents are difficult to gather together for group interviews, for example, farmers, fishermen, traders, government officials, gold panners and where the interviewee is prepared to become an informant only if he or she is able to preserve his or her anonymity.

The qualitative tools used include observations, archival research and interviews. These helped to facilitate the risk analysis process that was conducted.

The analysis in turn assisted in determining the nature and extent of risk by analyzing the potential hazards and evaluating existing conditions of vulnerability that posed a potential threat to people, property and the environment on which they depend upon (Smith 1996). The risk analysis was based on such technicalities of hazards as their location, intensity, frequency and probability; as well as the analysis of physical, social, economic and environmental dimensions of vulnerability and exposure. It should however be stated that though a qualitative paradigm was used, it was complemented with a quantitative paradigm to allow collection of as much data as possible.

4.3.2 Quantitative Research

Qualitative research in this study was complimented by quantitative data which helped to provide a complete picture of the research issue. The less precise but useful semi-quantitative approaches such as the questionnaire were used as well even if some researchers view it as decontextualizing human behavior, (Weinreich, 1996). Quantitative research according to Matveev, (2002), Smith, (1988) involves counting and measuring of events and performing the statistical analysis of a body of numerical data. It assumes that there is an objective truth existing in the world that can be measured and explained scientifically. Cassell and Symon (1994) in Matveev (2002) argue that the concerns of the quantitative paradigm are that measurements are reliable, valid, and generalisable in predicting the causal effect relationship. It can then be inferred that these methods ensure high levels of reliability of gathered information. They provide high level of measurement precision and statistical power. Quantitative research is borrowed from the physical sciences that are designed to ensure objectivity, generalizability and reliability (Wenreich, 1996). Thus it produces quantifiable, reliable data usually generalizable to some larger population. The techniques cover the way participants are selected, the standardized questionnaire they receive and the statistical methods used to test predetermined hypothesis

regarding the relationships between variables. The researcher is external to the actual research and results remain the same regardless of who conducts the study.

In this research, there are such aspects as the area size affected by artisanal small scale gold mining in terms of deforestation or vegetation clearance, the quantity of land or soil moved by artisanal small scale miners, the quantity of fish that have been found dead due to the contamination of water sources and rivers Kuja and Migori. However, efforts to outsource the quantity of dead fish from historical records, files and existing records from municipal Councils and the fisheries Department were fruitless and they refused with the information. There is the truth out there in the world about these quantities and thus how the quantitative research was incorporated in this study to verify them empirically on a set of data collected, (Frankfort-Nachmias and Nachmias, 1992). The quantitative approach according to (Wenreich, 1996) eliminates the researcher's own bias and subjective preferences. These methods were conducted on a population sample discussed below.

4.4 Population

The target population of the study included miners, officers from local government, various ministries departments (mining, health, Environment, natural resources, education, water) and the community. The population was classified into three broad stakeholder groups whose perspectives I felt were important to obtain in this study: artisanal small scale miners, the communities living around the mines and various institutions.

4.5 Sampling Techniques

The target population was comparatively too large to successfully examine under the time and budgetary confines of the study. I therefore employed a survey technique in sampling respondents and gathering information about ecological disasters associated with artisanal small scale gold mining in Rongo. This technique according to Kutar and Tilmaz, (2001) provides feedback from the interviewee's point of view. It is a technique for gathering information from a large number of people who are spatially distributed in the geographical space. Sampling is the inclusion or exclusion criteria for certain components from a population. The assumption is that every unit under observation carries the traits of the population from which it is drawn so much that decisive conclusions can be made from samples. An analysis of the costs, time and the

number of people required for the project were the determinants of the sample size. This study adopted simple random and strategic methods of selecting samples. It was random in the sense that there was no certain structure followed in selecting artisanal small scale miners as well as the households and strategic because miners and head of departments were earmarked for the research. It involved asking people questions, either verbally in an interview or in writing by having respondents complete a questionnaire. I asked respondents about their attitudes and opinions.

In quantitative terms, the total number of miners sampled was 10 people; head of departments 5 while the local communities 20 totaling to 35 respondents. For miners the simple random technique was employed to select samples from both Kitere mines and Sakwa mines where 5 miners were interviewed from each of the areas. This was also the case for visited households which were 10 from both areas. The research assumed artisanal small scale miners had similar traits and conditions and each one of them is believed to have represented the whole group. This therefore means that every group or individual found on site was deemed an eligible candidate to participate in this study. The research only recorded formal interviews and their account is given under research instruments.

It should be noted that there was some overlap among the three groups as some local community members interviewed were also artisanal small scale miners. Basically, five instruments used in this research to address the depth of the problem are discussed below and these are observations, interviews, questionnaires, photographs and checklists. The use of the methods and tools in this research were justified by looking at their advantages and disadvantages.

4.6 Research Instruments

The study used observational fieldwork, interviews and archival evidence from files and other records to ascertain themes arising from miners and stakeholders' perspectives. These data sources were triangulated to demonstrate reliability in the study. In this study interviews accounted for 15 people of which 5 were head of departments and 10 were miners.

Questionnaires accounted for 20 people who were members of the households in the local communities where the mines were located.

4.6.1 Observation

(Shishir, S. A. 2005) propounded that a broader range of information, potentially more open for discussion is acquired through observation of phenomenon. In observational research the researcher is mainly concerned with systematic observation of behaviour. This research dwelt on naturalistic observation which involves making systematic observations of behaviour in the environment where artisanal small scale mining occurs. In this study observations were made in the natural setting so as to provide high external validity. The instrument was used to describe setting, activities, people, the environment and the meanings of observed phenomena vis-à-vis the perspective of the participants so as to get knowledge of the context of Rongo district. Observation on such phenomena as siltation on the rivers, change in colour of water, the cleared land as well as the open pits were carried out in this research. The instrument was chosen because the study is of overt behaviour. Its behaviour however, did not close out other instruments to be used as well, as it was imperative to ask people about their behaviours and opinions.

4.6.2 Interviews

To uncover and explore deep seated emotions, motivations and attitudes of such sensitive issues like water and soil quality as well as past disasters, depth interviews were used by the researcher. To support the choice of interviews in this research, Nichols (1991:13), Wimmer and Dominick (1997:100) and Oatey (1999) argue that interviews are a suitable way to deal with sensitive or taboo issues, yet as a whole require a very good rapport to be established between the interviewer and the respondents. The researcher used a semi-structured set of topics to guide the discussion.

Jensen and Jankowski (1991:101) argue that interviews are useful in that they lead to further research using other methodologies like observation and experiments. For the purpose of this research a face to face interview that permitted the development of rapport between the interviewer and respondent was chosen. It was much relevant especially for exploring sensitive research topics such as those concerning water quality and land degradation which is the main driver of the ecosystems. In face to face interviews the interviewer worked in direct contact with the respondent.

4.6.3 Questionnaires

Questionnaires are relatively easy and inexpensive to formulate, analyse and communicate the findings. They were administered to 20 households. Brehob (2001) in Kuter and Tilmaz (2001:66) defines a questionnaire as “a form that people fill out used to obtain demographic information and views and interests of those questioned.

Questionnaires provided quantitative data whilst interviews provided qualitative data. They were used because they are appropriate for making statistical analysis. This research adopted both quantitative and qualitative methods of data acquisition so that both situations of qualitative and quantitative are catered for.

4.6.4 Photographs

Photographs enable a researcher to capture information at desired sites. The appeal of this technique relies on its ability to visualize scenarios being discussed in words. This method was used to supplement other techniques used in the field. Photographs were used to show the extent of land degradation, child labour involved, deforestation, siltation of rivers as well as risky shafts involved in the whole activity.

4.6.5 Checklists

These are guideline notes that were used in the research to ensure that interviews, observations or discussions with respondents were within the topic of study or interest

4.7 Data analysis and Presentation

Quantitative description and qualitative methods were used to analyse the information collected from respondents. It will involve grouping answers to various questions as answered by the respondents. Data presentation will be done through pie charts, graphs and tables

5 CHAPTER 5

DATA ANALYSES AND PRESENTATION

5.1 Introduction

Data presentation and analysis involved a set of interpretive and narrative techniques. All formal interviews held after important themes were coded. Data was broken down into manageable units, synthesized and patterns or themes were identified to make it possible for meaningful analysis (Leedy&Omrod, 2001). Critical themes and patterns identified are discussed, ranked and their causal relationship effect with gold mining established. Description of the opinions of respondents, both stakeholders and artisanal small scale miners, gave such specific trends and phenomena, which were used as a representation of the whole Rongo town.

Identification of themes emerging from raw data was achieved through an open coding system (Strauss & Corbin 1990). Themes relating to ecological problems of gold mining were identified from questionnaires, observations, and interviews supported by existing evidence. The themes were listed and their frequency in questionnaires used to calculate the frequency percentage and a frequency distribution graph used to analyse, ranking the themes in a hierarchical order to find out the themes that were much more pronounced. The frequency distribution graph account for the quantitative analysis, whilst the qualitative data was simply an analysis of the interviews and transcribing the themes in text. The data from the interviews were compared to the results of the frequency distribution of the phenomena. The analysis starts with the identification of ecological impacts of gold panning followed by the identification of specific hazards associated with the activity as well as the social impacts.

5.1.1 Data Analysis

The study used mainly the qualitative analysis as well as, but not much of, quantitative. Interviews, questionnaires, observations and existing evidence were conducted with 35 respondents in the town. In this study interviews accounted for 15 people of which 5 were head of departments and 10 were miners Questionnaires accounted for 20 people of who were the local community representing non miners conducted in different households. The local community and head of departments were referred to as stakeholders.

Data analysis was therefore carried out by calculating the percentage frequency of each phenomenon or theme using the frequency by which each theme appeared on the given questionnaires and interview.

Interviews, observations, photographs and existing evidence were then used to support the findings from the questionnaires. The findings of the study are therefore based on the data provided by the respondents. The following figure illustrates one set of results of the respondents used in this research and it shows their age group distribution by gender.

(GRAPH 1)

From the graph, Figure 5.1, 40% is the total of male stakeholders who responded whilst women representation is at 60%. Male miners are at 70% while their women counterpart whose role is sieving and transportation of soil carrying ore is at 30%. Stakeholders' respondents included the Rongo Municipal Council, Ministry of Health, Ministry of Mining and Natural Resources, Ministry of Lands, and the Local community, Only heads of departments were chosen for this study.

5.2 Push and Pull Factors behind Mining in the Region

The main drivers behind engagement into artisanal gold mining were established as lack of employment, income from the precious metal and family trends. These can be classified into both pull and push factors. Lack of employment was ranked top with 80% from miners and 60% from stakeholders, followed by income, a pull factor which is at 28% for stakeholders and 20 % for miners, and lastly family trends and tradition which was 12% for stakeholders and 0% for miners Figure 5.2 below is an illustration of the drivers.

5.3 Impacts of Gold Panning on the in Rongo

5.3.1 Ecological Problems

Stakeholders and panners acknowledged that they were aware of ecological problems associated with gold mining that have created certain identified specific hazards affecting certain elements in the environment. Both parties were issued with questionnaires requesting them to identify and list the ecological problems, specific hazards and the elements affected by the hazards. In the same vein interviews also sought out to identify if the same themes could be raised. Observations show the gravity of these ecological disasters. Pictures of derelict lands and destroyed vegetation were taken. A multiple response analysis indicated both ecological (Figure 5.3) and social problems (Figure 5.4) and these are shown in the graphs below. The percentages shown in the graphs were calculated using the number of times (frequency) they appeared in questionnaires expressed as a percentage of the total questionnaires in each series (stakeholders and miners).

Gold mining in the Rongo is transitory. Mining involves majorly open-pit and underground operations as well as alluvial mining along river Kuja. The ore is then crushed and panned. Waste rock is dumped into heaps as tailings. Mining in the area has left behind dredged out and contaminated streams, disturbed vegetation and littered landscapes, open trenches and gaping pits filled with water. For example, at KamagambokaMwango mine, one can easily identify the scars remaining from the 1930s to 1960s large-scale mining. The mine site is heaped with featureless flat tailings, which are partly washed on to adjacent land, pulled down buildings and machinery and debris of scrap metal. Artisan miners who have been trying to rework the tailings within the mine dump and old processing plants have worsened land degradation. Plant growth on the wasteland is inhibited, and this seems to be due to acid mine drainage. Toxic compounds and heavy metals previously locked in the undisturbed strata and minerals are leached to the environment. During gold rushes to the area, the large number of miners put much pressure on the environment in terms of energy resources; thus large quantities of trees are cut down either as firewood or as timber for support of weak mine workings. This causes deforestation and soil erosion. Options for restoration of landscape in the mining areas are not easy. One such option is to refill the mine, using the waste rock once mining is over. However, this option is difficult to implement because most of the miners are not landowners, thus they quickly abandon the exhausted site and move to new productive ones.



Plate 5.1: Land cleared for artisanal mining in Kitere area

Most of the miners also operate under risky shafts that often collapse mostly during the rainy seasons due to their weak and crude nature. Some of these shafts are also always left dismantled nor the land backfilled. They are after several months covered with vegetation giving a false impression of a normal ground surface posing several risks to visitors and children in the area who are always unaware of the presence of the abandoned shafts



Plate 5.2: An artisanal miner operating under a crude shaft

The study also revealed that water contamination is associated mainly with panning along streams and rivers. Evidence of possible pollution includes siltation and water coloration due to chemical reactions, resulting in the formation of sulphuric acid and ferrous hydroxide. The streams show orange coloration and the water is acidic, depicting chemical pollution. Rivers that have been affected by pollution include the, Kuja and Migori rivers.



Plate 5.3 miners carrying out alluvial mining along river Kuja

The local community depends on the water from these rivers for domestic use; unaware of the dangers posed by their pollution. Fish is also the main source of food in this area; thus fish is obtained from contaminated rivers. The possibility of heavy metal contamination reaching Lake Victoria, which is only 15km from Sakwa, is quite high. Groundwater pollution in the mines is partly due to dumping of used batteries within mine workings and partly due to poor sanitation underground. Cases of groundwater causing itching are common. Past analysis of such waters gave the following chemical composition: 96.10mgL^{-1} Na, 26.10mgL^{-1} Mg, 4.89mgL^{-1} K and 3.53mgL^{-1} Ca. The water is strongly alkaline and this can be attributed to alkaline batteries being used in torches underground

5.3.2 Social Problems

During the investigations carried out it emerged that Rongo town was also grappling with social problems emanating from gold panning as indicated in Figure 5.4 below, these social problems included, drug abuse, prostitution, child labour, land use conflicts and mercury related diseases.



Plate 5.4: Young children involved in artisanal mining

5.4 Management and Characteristics of the Mines

From the various interviews and questionnaires as well as photographs taken, I was able to get information concerning how the miners manage these mines, who own the mines, the market for the gold as well as the sizes and prizes.

According to the miners, these mines were managed and owned by families where the mines existed apart from those that were found on public land that had no specific form of management. In the family based mines, the miners were mainly family members together with a few people outside the family and also the mill owners. They collected the bags of ore carrying soil and either sold them in the unprocessed form to various brokers or processed it in the mills and sell the end product which is gold.

They claimed the brokers however paid so little amount for the gold since they were not aware of any available market apart from them, a factor that made the brokers carry out the exploitation.

They stated that 1 gm. of gold would go for two thousand Kenyan shillings and it would take them around a whole week to come up with that amount, which would take at least 20 bags of soil to process.



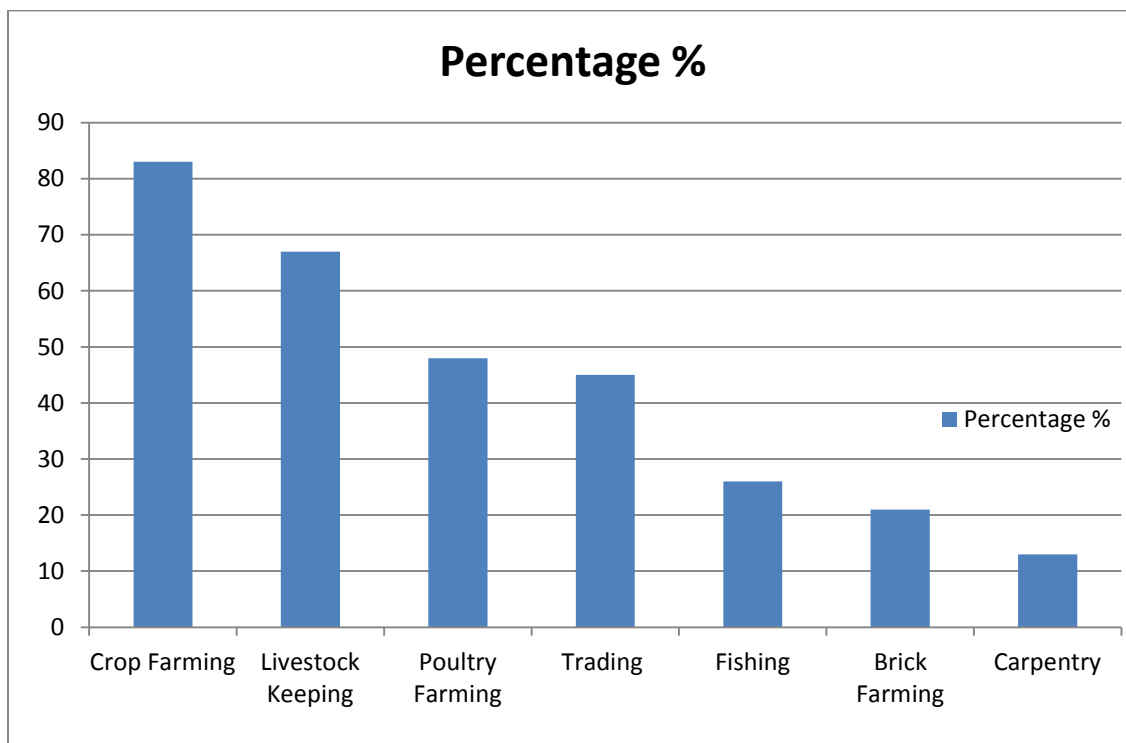
Plate 5.5: A miner showing 1gm. of gold

Most of these mines were small in sizes since they involve manual labour of few individuals. Their sizes ranged from 10 m² to 40 m²

5.5 Alternative Preferred Economic Activities

The miners and the various stakeholders who responded in the activity were also asked about the alternative economic activities that could replace mining in the future. The frequencies of their preference are presented on figure 5.4 below. These are those activities that are more common and preferred to mining in the region and that the respondents considered to be of more benefit.

These activities were in the order of, crop farming 83%, livestock keeping 67%, poultry farming 48%, trading 45%, fishing 26%, brick making 21% and other activities e.g. carpentry at 13%

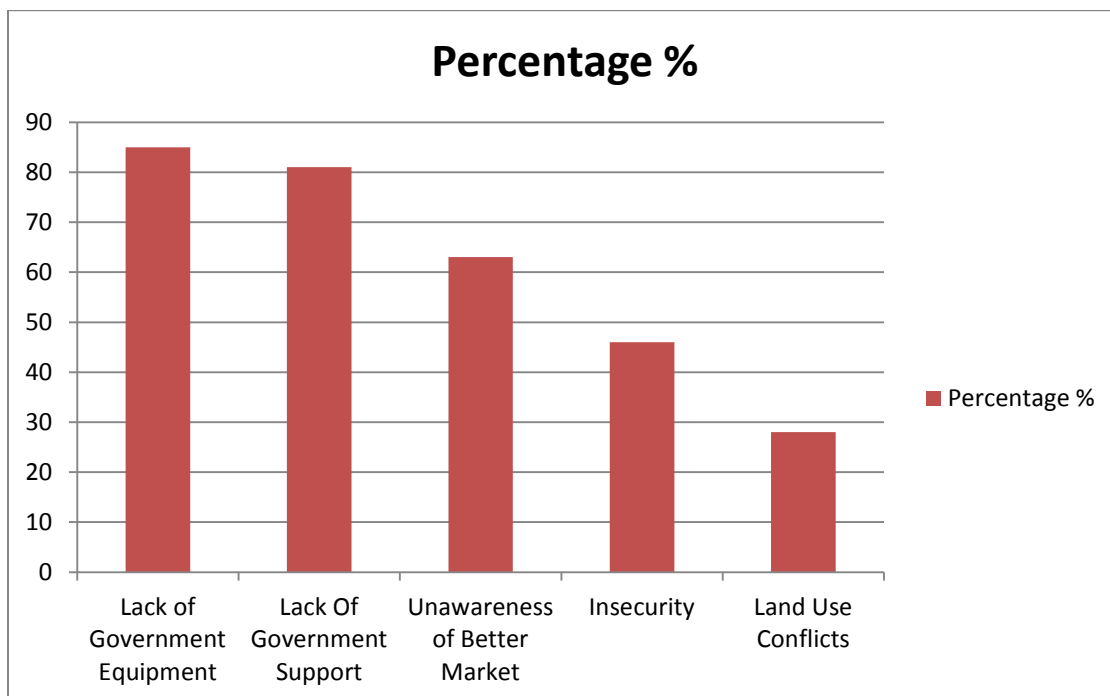


When asked about the benefits they obtain from the mining activities, only 28% of the respondents acknowledged that they acquired various benefits from the mining and these were only the interviewed miners. Most people were not for the support of the continuation of the mines as they claimed it only benefited the people worked in the mines, and that the benefits were not that great compared to other economic activities that would be put in place to replace mining e.g. farming

They also opposed the continuation since it had more negative impacts than positive, citing prostitution, child abuse, land damage as some of the bad impacts.

5.6 Challenges Facing the Mining Industry in Rongo

Artisanal small scale gold miners worldwide face various challenges in carrying out their activities. From the questionnaires and interviews provided. The challenges are presented on the graphs in figure 5.5 below showing their frequencies. These challenges included, lack of equipment, lack of government support, lack of available market, land conflicts as well as insecurity. The challenges were in the order of, lack of modern equipment 85%, lack of government support 81%, unawareness of better market 63%, insecurity 46% and land use conflicts at 28%



6 CHAPTER 6

RECOMMENDATIONS AND CONCLUSION

6.1 Recommendations

In light of the foregoing discussion it is clear that artisanal small scale gold mining in Rongo poses a serious threat to the ecology which in turn jeopardises human lives and their livelihoods if the problem remains unabated. The cascading effects of vegetation degradation, land degradation, and water pollution may appear insignificant to some populations, but are real and their cumulative effect needs to be mitigated to reduce their impact I Rongo and the and the neighboring community as a whole. It needs to be stated that such environmental elements under threat as water, land, soil are non-renewable economic resources that man depend on for survival. Thus for man to continue enjoying these benefits sustainable means of exploitation are crucial. It emerged from the research that stopping artisanal gold mining at the moment is not a viable solution since people are being forced into the activity mainly by lack of employment, and general poverty affecting the whole country. Gold mining seems to be one of the meaningful income generating project in this town. The government and the whole community therefore needs to come up with strategies that seek to reduce destruction of the ecological system. Such strategies as discussed below include policing, penalties, taxes, provision of mining licenses at affordable fees, equipment, training and environmental awareness campaigns and education to both informal and formal small scale gold miners:

Policing – currently in Kenya there are no clear rules and regulations governing gold panning operations, no one wants to be involved in problems pertaining to such an activity because it is deemed illegal. However, ignoring it is not helpful at all because it is something already going on in the country and it has got adverse effect to almost every citizen one way or the other. First and foremost it is necessary to have a policy aimed at mainstreaming disaster risk reduction in all artisanal small scale gold mining activities. Therefore there is a need for a collaborative effort amongst key ministries and stakeholders concerned with land and natural resources to come together and come up with a policy that will guide prevention and mitigatory plans in artisanal gold mining activities.

Raising awareness and environmental education – the research indicates that most artisanal small scale miners are ignorant of long-term effects of their activities. Therefore there is need for extensive education to the local community about the environmental dangers and their long-term effects and conscientising them of the need for health ecosystems. Miners need to be taught on the risks involved in chemicals they are using. To reduce unplanned destruction of natural resources Miners need to be made aware that the environment is for future generation for them to mine with due care.

Training – mining is an activity that requires a skill for it to be carried out sustainably. Thus the county government and the Rongo municipal Council need to take it upon themselves to organise training workshops for artisanal small scale miners in order to reduce associated disaster risks.

Licensing and giving permanent claims to miners - it is imperative to regularise and formalise all gold mining activities through licensing, giving permanent claims and operating permits to miners to recoup some of the added costs in the form of taxes.

Strengthening of already existing structures – at the moment law enforcement agents, the Kenya Police, Municipal Council Askaris and NEMA are the ones responsible for monitoring and protecting the environment from illegal mining activities. However it emerged from the research that these agents are ineffective because they are under-resourced or concentrate on other illegal activities that can generate a lot of bribes. Thus they require reinforcement and close monitoring through follow-up structures

Mechanisation –The government needs to offer help to miners in the form of loans, safety clothing and machinery to improve on their activity. They can also be encouraged to form cooperatives where they will mine sustainably and create formal employment. The government also needs to create investor confidence so that investors can come and mine thus creating jobs for locals.

Land rehabilitation – to reduce land degradation and ecosystems disruptions, artisanal small scale gold miners have to backfill their excavations. This will go a long way in protecting wildlife and livestock from falling into pits. According to the requirements of the Forest Commission one has to plant two trees after cutting one tree. Thus panners need to be encouraged to practise such ethics if the environment is to be sustained. Miners have to be part of

EIAs process so that they can understand and implement safer methods. Taxes and fines paid by offenders should be channelled into projects that seek to mitigate against water pollution, deforestation, land degradation and loss of biodiversity in the town

6.2 Conclusion

This chapter is a summary of the research study done in Rongo town to establish socio-ecological disasters posed by the artisanal small scale gold mining activities occurring within the town. Recommendations to alleviate problems linked to gold mining are also given. The study contains the strategies used in gathering data from all stakeholders who make up key informants, data analysis and presentation in the form of figures and graphs.

The study is mainly qualitative although quantitative research methodology was also used in data gathering and analysis. Views, opinions and attitudes of people concerning artisanal small scale gold mining and its impact on ecology was collected through instruments that included interviews, observations, questionnaires photographs and the review of existing evidence. Interviews chosen included a semi structured type using open ended format of questions to allow the interviewee to give as much information as possible pertaining to the subject. The element of its semi-nature means that the list of topics can be changed in the course of the interview depending on the reaction and response of the respondent. The in-depth interviews are a one on one encounter concluded at length that enabled the researcher to tackle sensitive and/or partially embarrassing topics.

Participants in this research included artisanal small scale gold miners themselves who were selected randomly, community members, and local leadership. Other stakeholders included various organisations. Representation from these was chosen strategically; only heads of departments were chosen to represent the organisation. Graphs and tables were used to represent information gathered in this research.

The research in the socio-ecological effects of artisanal small scale gold panning in Rongo was necessitated by the rate at which land degradation, siltation of rivers Kuja and Migori, deforestation and water pollution as well as rising rate of prostitution, child labour and drug abuse is taking place interfering with the natural ecosystems on the environment and social well-being. Environmental elements such as land, soil, water, flora and fauna face serious damage if

not total extinction and or alteration due to prevailing , water pollution and land degradation as a result of gold mining going on.

Miners highlighted that they were aware of the problems created by their operations but are forced by lack of employment and poverty prevailing in the town and the nation as a whole. They were so concerned about the dangers of gold panning and expressed fear for their lives as they were at risk due to shaft collapse which had injured and claimed lives of many in the past. Vegetation degradation, land dereliction as well as noise ground vibration were ranked by miners as the highest enemies of the environment.

Policing, penalties, and payment of taxes were given as some of the mitigation strategies that could be employed to enforce environmentally friendly practices by artisanal small scale gold miners.

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Presentation from Mr. Golden Hainga, General Secretary of the Mwanza Regional Miners Association, Tanzania. ASGM Global Forum in Philippines 7-9 December, 2010.

APPENDICES

APPENDIX A: HOUSEHOLD QUESTIONNAIRE

KENYATTA UNIVERSITY

Department of Environmental Planning & Management

Introduction

I am a Kenyatta University undergraduate student pursuing a Bachelor in Environmental Planning & Management. I am carrying out a research on the impacts of open cast mining in Rongo town.

I am kindly requesting for your time to answer some questions. The information you will provide shall be solely be used for academic purposes

Bio data information _____

Name of the interviewer _____

Household Head Name _____

Respondent(s) Name _____

Relationship of respondent to household head _____

Household type (select only one)

Male headed and managed

Male headed and female managed

Female headed and managed

Child headed (below 18yrs)/orphan

How many parcels of land are owned and/or accessed by the Household?

What is the total size of all the land owned (in acres)?

A. BACKGROUND INFORMATION

i) Why did you decide to settle in this area?

ii) How long have you lived in this area?

Less than 10years [] 31-40years [] 21-30years []

10-20years [] More than 41years []

B. OCCUPATIONAL/ECONOMIC ACTIVITIES

i) Are you employed? Yes [] No []

ii) Do you practice any type of economic activity? If yes specify

	YES	NO
Crop farming		
Livestock keeping		
Poultry keeping		
Fishing		
Trading		
Brick making		
Others (specify)		

iii) Does the mining in area have any impacts on the activity mentioned above? If yes specify

C. MINING IMPACTS

- i) Are you well conversant with the mining activities in the area?
Yes [] No []
- ii) How far is from your home from the mines?

- iii) Do you benefit in any way from the mining in the area?

- iv) Do you experience or notice any of these impacts as a result of mining in the area?

IMPACT TYPE	Experienced		Noticed		Frequency	
	Yes	No	Yes	No	Yes	No
SOCIAL IMPACT						
i) High Cost of Living						
ii) Child Labour						
iii) Land Use Conflicts						
HEALTH IMPACT						
i) Drug Abuse						
ii) Prostitution						
PHYSICAL/ENVIRONMENTAL IMPACT						
i) Noise and Ground vibration						
ii) Air pollution						
iii) Chemical pollution						
iv) Environmental disaster/ deaths						
v) Physiological disorder of crops						
vi) Land and vegetation degradation						
FOOD SECURITY						
Low food production with time						

v) Apart from above, are you aware of any other impacts?

vi) Elaborate the above mentioned impacts.

vii) What do you think can be done to mitigate the above impact?

viii) Do the miners practice any land reclamation activities after mining?

ix) Who owns and who manages these miners?

x) Do you support the continuation of the mining in the area?

xi) what other land use practices do u think can be undertaken on the land apart from mining?

	YES	NO
Crop farming		
Livestock keeping		
Poultry keeping		
Fishing		
Trading		
Brick making		
Others (specify)		

CHALLENGES FACED BY MINERS

- 1) According to you what are some of the challenges faced by the miners?

Challenge	YES	NO
Lack of government support		
Insecurity		
Lack of better equipment		
Market challenges		
Land use Conflicts		

- 2) How do you think these challenges can be addressed?

D. EXISTING POLICIES & LEGISLATION FOR MINING CONTROL

- 1) Are you conversant with any legal provisions controlling mining activities? If yes elaborate

Yes [] No []

- 2) In your opinion is there any gap in the existing legislations?

- 3) Are the mines managed by co-operatives?

- 4) Are the mining activities licensed by the local authority?

- 5) Do you think the local government is effective in controlling these activities?

- 6) In your own opinion, what do you think can be done to control these activities?

APPENDIX B: MINERS INTERVIEW SCHEDULE

KENYATTA UNIVERSITY

SCHOOL OF ENVIRONMENTAL STUDIES

DEPARTMENT OF ENVIRONMENTAL PLANNING AND MANAGEMENT

DECLARATION; the information obtained from the respondent as part of this study will be confidential and will only be used for academic purposes

IMPACTS OF OPEN PIT MINING OF GOLD

Name of respondent

Location of mine

Date of interview

- 1) For how long have u been engaging in the mining activities?
- 2) Why did you decide to undertake the activity?
- 3) What is the amount of gold that you get on a weekly basis?
- 4) What other economic activities do u practice apart from mining?
- 5) Who are the owners and managers of the mines?
- 6) Are you aware of the dangers associated with the mining activities?

- 7) What are some of the challenges you face in the activity?

- 8) Do you receive any support from the government in carrying out the mining?

- 9) What are your recommendations towards achieving a sustainable mining activity in the area?

Thank you for your time and responses

APPENDIX C: INSTITUTIONAL INTERVIEW SCHEDULE

KENYATTA UNIVERSITY

DEPARTMENT OF ENVIRONMENTAL STUDIES

DECLARATION: the information obtained from the respondent as part of this study will be confidential and will only be used for academic purposes

IMPACT OF OPEN PIT GOLD MINING

Name of institution:

Location:

Name of respondent:

Date of interview:

- 1) Are you aware of the mining activities carried out in the area?

- 2) Does your institution, directly or indirectly carry out any activities related to mining?

- 3) Are your activities affected directly or indirectly by the mining in the area?

- 4) Are you aware of any dangers resulting from the mining activities, if yes elaborate?

- 5) What are some of the challenges faced by these miners?

- 6) How can these challenges be addressed?

- 7) Does the government support the miners in carrying out their activities?

- 8) Do you support the continuation of the mining activities in the region?

- 9) What are your recommendations towards achieving sustainable mining activity in the area?

Thank you for your time and responses