The implications of Artisanal Gold Mining Practices on Livelihood Security in Uganda

By

Herbert Nabaasa

REGISTRATION NO: 2014/PHD (MGT)/035/PS

Supervisors

Dr. Willy Ngaka,

Makerere University

Rev.Fr.Dr. Odubuker Picho Epiphany

Muni University

A PhD Proposal submitted in the fulfillment of the requirements for the award of Doctor of Philosophy in Management of Mbarara University of Science and Technology (MUST)

January 2016

TABLE OF CONTENTS

Acronyms

AGM	Artisanal Gold Mining
ASM	Artisanal and Small Scale mining
AMD	Acid Mine Drainage
DLG	District Local Governments
FAO	Food and Agriculture Organization
GDP	Gross Domestic Product
IIED	International Institute of Environment and Development
ILO	International Labour Organisation
MEMD	Ministry of Energy and Mineral Development
MAAIF	Ministry of Agriculture Animal Industry and Fisheries
NEMA	National Environment Management Authority
UBOS	Uganda Bureau of Statistics
USAID	United States Agency for International Development
WBCSD	World Business Council for Sustainable Development

CHAPTER ONE

INTRODUCTION

1.1 Introduction

Artisanal gold mining (AGM) is one of the emerging economic activities providing alternative livelihoods globally with more than 13million artisanal miners and about 150 million people indirectly reliant on AGM (ILO, 1998). A large proportion of artisan miners mainly in Africa are women and children who are also important in supporting sustainable livelihood security. However, their extensive involvement in the informal mining operations sharply affects other livelihood interventions for which they hold key roles (Hentschel, 2003).

In Uganda, Artisanal Gold Mining is on the increase and is largely a poverty-driven activity used as a coping mechanism with thousands of local communities currently engaged in the mining practice (MEMD, 2011). The communities in the mining sites live in deplorable sanitary conditions, use toxic chemicals such as mercury in the gold extraction and have severely degraded fragile ecosystems that support their livelihoods (Kinene 2012).

The government of Uganda still regards AGM as an illegal practice providing no regulatory and policy framework to guide the mining operations. The absence of evidence based strategies for sustainable mineral exploitation exacerbates the situation (MEMD 2009). Despite the growing trend of community engagement in artisanal gold mining practice, the implications of the mining on the livelihood security are largely unknown. This research therefore seeks to explore artisanal mining implications on

livelihood security with the aim of developing best practice strategies and inform other necessary interventions.

1.2 Background

1.2.1 Historical background

The international interest on artisanal gold mining (AGM) has evolved over time looking mainly at; the definitional issues, technical, legal, Gender, Environmental and Social Economic issues and some important linkages that exist (Hentschel et al 2003; Hruschaka et al 2002; Hinton 2011; Bastia, 2004; Chaparro, 2003; WHO 1995; Ibrahim, 2003; ILO, 1998; Carmouze, 2001).

It is important to note that most of the historical artisanal and small scale gold mining episodes evolved in form of "gold rush". Gold rushes extend back as far as gold mining history, to the Roman Empire, whose gold mining was described by Diodorus Siculus and Pliny the Elder, and probably further back to Ancient Egypt. (Hinton, 2011)

The recent massive involvement of communities in artisanal gold mining operations particularly in Africa is typical gold rush stereotype (ILO, 2012). The gold rush is a period of feverish migration of workers to an area that has had a dramatic discovery of gold deposits. Major gold rushes took place in the 19th century in Australia, Brazil, Canada, South Africa, and the United States, while smaller gold rushes took place elsewhere in the world (Reeves, 2010, Eane, 2009).

Hentschel (2002) notes that despite some level of recognition, implementation of legislation among the mining communities remains problematic and many miners do

not have faith in the ability or commitment of their governments to provide assistance and as a result the miners have depended on the middlemen further exacerbating the situation in the mining operations, a reason it has remained informal.

In Uganda, mining started in ancient times by artisans. Formal mining started with arrival of the British Explorers during the colonial times. Copper, phosphates, limestone and several small- medium mines for tungsten, tin, beryl, niobium, tantalum, gold were operated (1930s-60s). During 1950s-60s, mining contributed about 30% of foreign exchange earnings.

In 1970s, due to political crisis, exodus of skilled man power, economic sanctions and the collapse of the economy, the mining industry collapsed. In 1990s, rebuilding of the nation started but mining sector was not a priority and it was not easy to get back investors. Mining continued on small scales. Then some medium scale mining started especially that of strategic minerals such as limestone for cement manufacture, but precious metals, base metals and others continued to be exploited on small scales and as a result of limited or lack of regulations, artisanal gold mining has recently sprung up in many parts of the country (MEMD, 2013).

1.2.2 Theoretical background

1.2.2.1 The Classical Theory of the informal sector

The informal sector is defined as processes which, at prevailing wages, will not return the average rate of profit in the long run. Informal sector producers operate these defective processes because they have no alternative and when these individuals cannot find more remunerative formal sector employment, they are reduced to informal sector activity as their sole means of reproducing themselves. Thus there is "full employment" in the model, but not in the neoclassical sense of flexible wages and formal labour markets (Gibson, 1994).

Bill Gibson and Bruce Kelley (1994) note that in terms of informal sector theories, several scholars have analyzed the informal sector particularly from the historical and empirical point of view. Gibson notes that theoretical perspectives on the informal sector are still sparse.

The classical theory posits that the common unifying principle which underlies the previous literature is that the informal sector arises from the capital-limited nature of the economy and where capital is not in short supply, all activity would be formal.

Thus, the classical theory is based on the notion that informal sector processes are processes which will not return the average rate of profit when evaluated at the prevailing level of wages and prices and will not be operated by capitalists who require the average of return. The theory very well resonates with several scholars who assert that artisanal mining is largely inform and often illegal with most

communities turning to it as a poverty coping mechanism (Hentschel, 2011, MDLG, 2013).

Under the informality nature, the economies are limited by exogenous level of demand which forces unemployed workers and "unemployable illiterates" to join the informal sector making "neither nor scenario" workers who are neither capitalists nor workers but who rather constitute a distinct social class. In some instances, in the short run, the informal sector processes may earn positive or negative profits but in the long run, the implicit wage in the informal sector determines the formal sector wage rate (Gibson, 1994).

Under this theory, if the initial conditions are appropriate, the informal sector will eventually earn the average rate of profit becoming in effect formal but if this case scenario does not suffice, then it is possible that this adjustment path is blocked so that the model converges to a lon-run equilibrium in which both formal and informal sectors coexist.

The theory generalizes that the informal sector technologies are largely rudimental and labour productivity is characteristically low, overhead or fixed capital is minimal and intermediate inputs, especially imports are not nearly plentiful as in the formal sector if at all they exist. This scenario contrasts with the general understanding that artisanal mining is highly rudimental employing low technological equipment such as hand tools and applying polluting and toxic chemicals chief among them Mercury and Cyanide which are not only ecologically sensitive but have serious health impacts (Hentschel, 2011)

Various studies indicate that the marginal commitment of financial capital to create a job is a fraction of that of the formal sector resulting in policy makers to think that the informal sector is a cheap means of employment creation. This is largely reflected in the fact that informal mining operations by communities whether profitable or not are still illegal. Most governments particularly in Africa, have not labored to provide regulatory and policy framework for the sector making it one of the most highly disorganized and illegal livelihood adventures (Hinton, 2011).

1.2.2.2 The Theory of Property Rights and regulation of Artisanal Mining

Fabian Clausen, Maria Laura and Amir Attaran in a 2011 publication by the Canadian Center of Science and Education provide insights on how the theoretical justification of property rights influences attempts to formalize informal sectors including providing legal regimes for regulating the informal operations such as artisanal mining.

Different scholars have several definitions for a property. A property is a legal institution that governs the use of things (Barnes, 2009). Property is viewed by many from a narrow sense of private context; however, it also has social and public dimensions as it provides the means to achieve sustainable development, particularly the social order and the mode of public and economic organization (Singer, 2000). As several scholars assert, the structure of a property system influences how societies are shaped and how people interact (Fabian, 2011).

Fabian (2011) further indicates that; how one understands and justifies the existence of a property influences the kind of property necessary to manage certain resources and that, the understanding of property theories has an impact on how much state

regulation particularly for the private property is tolerated. The understanding of property rights helps to know who is given what kind of rights over his property, setting requisite rules to govern the acquisition of property, and how conflicts between property owners are potentially resolved (Barreto, 2011). In articulating issues of informal sector and with particular reference to artisanal mining, it is important to acknowledge the fact that land rights and ownership dynamics greatly influence the sector. Thus the theory of property rights particularly from the land and economic rights point of view must be explored including efforts to regulate artisanal mining operations not only as government policy but also as an economic tool of empowerment.

One fundamental issue is clear in respect to informal mining by individuals and communities, the fact that all artisanal mining operations globally and particularly in Africa, conflict is common practice and as such adequate regulatory solutions must be found to make the sector meaningful. This is entirely because mining is an economic asset and more so takes place on the valued property- the land resource, thus property issues arise in the context of land use. In most cases, miners will not own the land on which the minerals are located. This leads to questions of land allocation, for example if the government should set aside specific lands for Artisanal Mining, and what provisions are made with regards to other private owners of land on which minerals happen to be located.

Thus, from a theoretical point of view, some basic questions underlie all of these issues: how much space do governments grant private actors regarding the use of their property, and how much government regulation is acceptable? Or, in other words;

how "strong" are the private property rights vested in the respective actors? and how should concerns of property distribution be addressed within the property system itself? (Long, 1995)

It is important to note that over 90% of artisanal and small scale mining practices are not regulated and as such have no secure property rights and do not actually pay any form of taxes. Thus, the first and fundamental question that the proponents of this informal sector should ask is: should we create a formal framework that promotes Artisanal Small Scale Mining at all, or is informality in fact more efficient?. In order to answer this question, it is imperative to undertake a cost-benefit analysis to justify the rational implications and how defining this would help balance legal-economic requirements (Hentschel et al, 2002).

Hruschka and Hentschel assert that the costs of drafting and disseminating laws, and the possible deterring effects these laws might have for large-scale mining, would have to be weighed against the expected benefits of participation in the law. The prevalent and common trend is that governments prefer creating private property rights as it is always more efficient due to the total wealth it generates, and formality is preferable to informality (Hentschel, 2002). This is particularly true because governments expect taxes and royalties from the formalized miners and reduced smuggling of gold to neighboring countries as a result of unregulated and informal mining operations (Hruschka et al, 2002). The question one would ask is; if governments prefer formalized structures why has artisanal and small mining remained largely informal?; but as several scholars assert, governments view artisanal

mining operations as illegal requiring no formalization as miners seemingly have no property rights over the mining land resources (Hinton et al, 2011).

1.2.3 Conceptual background

The European Environmental Agency (EEA) and most Environmental Protection Agencies (EPAs) in the world have developed a framework approach for reporting on the state of environment and the livelihood linkages using Drivers, Pressures, State, Impacts and Responses (DPSIR) which is now widely seen as a structure within which to present the indicators needed to enable feedback to policy makers on environmental quality, livelihoods and the resulting impact of the political choices made, or to be made in the future. The EEA framework is in tandem with the Cause-Effect frame wok by Corvalán (1999), as modified from the framework for the development of environmental health indicators (Briggs,1996).

According to the DPSIR framework, there is a chain of causal links starting with '*driving forces*' (economic sectors, human activities) through '*pressures*' (emissions, waste) to '*states*'(physical, chemical and biological) and '*impacts*' on ecosystems, human health and functions, eventually leading to political '*responses*' (prioritization, legalization, target setting, indicators) (EEA, 1998).

A 'driving force' is a need which can both be primary or secondary. Primary driving forces for an individual are for example; the need for shelter, food and water, while examples of secondary driving forces are the need for mobility, entertainment and culture. For an industrial sector a driving force could be the need to be profitable and to produce at low costs, while for a nation a driving force could be the need to keep

unemployment levels low. In a macroeconomic context, production or consumption processes are structured according to economic sectors (e.g. agriculture, energy, industry, transport, households).

Driving forces lead to human activities such as transportation or food production as a means of meeting a need. These human activities exert 'pressures' on the environment, as a result of production or consumption processes, which can be divided into three main types: (i) excessive use of environmental resources, (ii) changes in land use, and (iii) emissions (of chemicals, waste, radiation, noise) to air, water and soil which exert positive or negative impacts on livelihoods (NEMA, 2012).

As a result of pressures, the ‘state’ of the various components of environment such as air, water, soil is affected in relation to the functions that these compartments play. The ‘state of the environment’ is thus the combination of the physical, chemical, human and biological conditions (EEA, 2003).

The changes in the physical, chemical or biological state of the environment determine the quality of ecosystems and the welfare of human beings. In other words changes in the state may have environmental or economic ‘impacts’ on the functioning of ecosystems, their life supporting abilities, and ultimately on human health and on the economic and social performance of society (EEA, 1999).

A ‘response’ by society, individuals or policy makers is the result of an undesired impact and can affect any part of the chain between driving forces and impacts. An example of a response related to driving forces is a policy to change mode of transportation, e.g. from private cars to public trains, while an example of a response related to pressures is a regulation concerning permissible levels of emissions or

deterrence measures to minimize soil degradation. The response from this research is the designing of a strategy to address the imbalances in the artisanal gold mining practice and proposing other interventions that seek to ameliorate the practices.

1.2.4 Contextual background

1.2.4.1 Artisanal Gold Mining in Uganda

Uganda lies within the African plate, which is a continental crust that contains Archaean cratons that date at least 2700 Ma. The country's geology endowed with a wide variety of minerals has been grouped into various geological litho-stragraphic domains. Particularly, the gold industry has seen a radical increase in gold production to 7tonnes of gold in 2000, up from 225kg produced in 1994 (MEMD, 2013).

Gold appears to be widely distributed throughout Uganda, but has only been exploited by artisanal miners in a few areas near Busia (East), Buhweju and Kigezi (Southwest), Mubende (central) and more recently, Karamoja in the northeast. Most of the gold mined is located in small, high grade alluvial deposits located around the Proterozoic basins such as those in Buhweju. The Busia goldfield is considered an extension of the Lake Victoria Goldfields located in Tanzania (MEMD, 2012). Gold contributes up to 30% of export revenues from Uganda (NEMA, 2014).

Uganda's gold production has increased largely due to deregulation of gold sales by the Central Bank as well as gold from neighboring DRC being sold in Uganda and mining is currently spread across many parts of the country as indicated in figure 1 below.

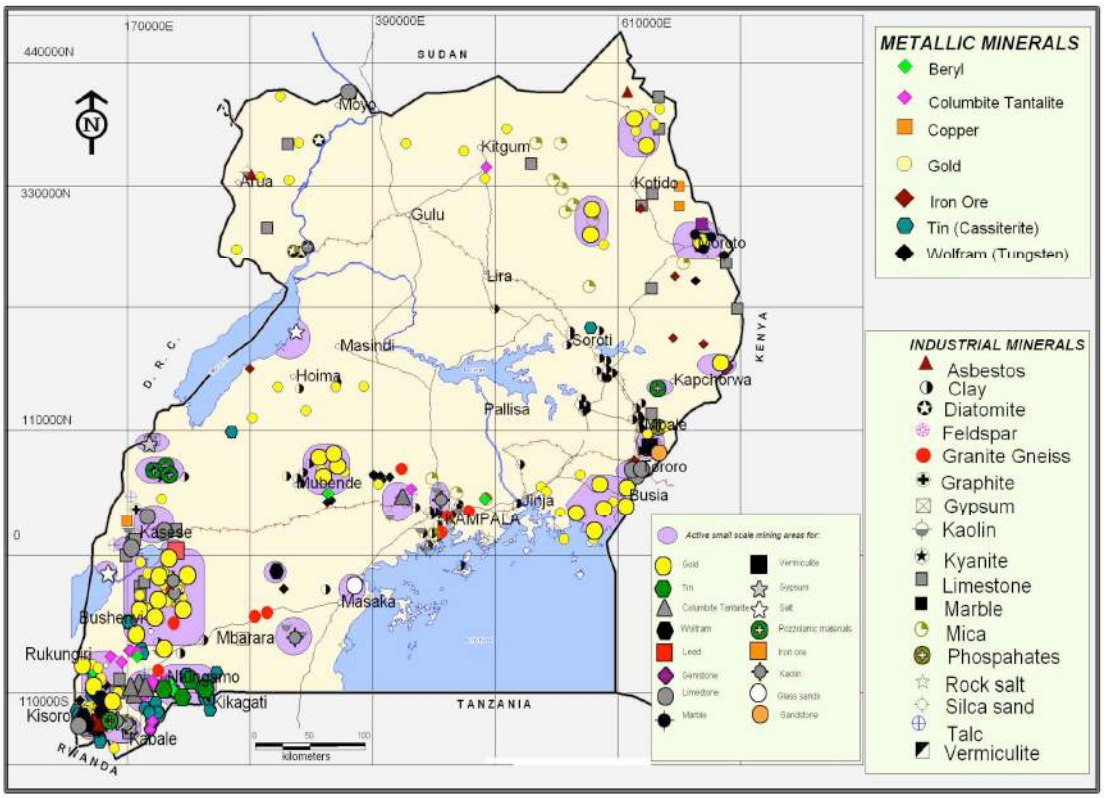


Figure 1: Artisanal and Small Scale Mining Areas in Uganda

In Mubende district, South Western Uganda, there is an influx of over 3000 illegal gold miners in Lugingi A and C and surrounding areas near Katugo village in Mudadde parish and in Lugingi A and Lugingi C villages in Kijuna Parish in Kitumbi Sub County. According to reports, illegal gold buyers from as far as Congo, South Sudan, Rwanda, Burundi and Nebbi throng this place in search for gold. Most of this gold bought in points, grams and tollers finds its way in Kampala where it is refined by licensed gold dealers before exported to the Middle East (MEMD, 2013).

Majority of the miners who purchase small plots of land from land owners in Mubende between sh2-10m also accuse the district officials of fueling the illegal trade and mining (MDLG, 2012).

1.2.4.2 Livelihoods and Artisanal Mining Nexus

A livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living". It is considered sustainable "when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base (ibid. 1999).

A number of studies highlight linkages between artisanal mining and people's livelihoods mainly in countries with considerable high rate of engagement in artisanal mining. Asia is one of the continents with the highest number of people involved in Artisanal Small Scale Mining (ASM) but it is the least covered by the ASM literature and this is the same with Africa (Labonne et al 2001). However, several scholars have looked at some livelihood security indicators such as education, capital, employment and possible vulnerabilities that characterize the sector (Labonne and Gilman, 1999; Labonne et al., 2001; MIME Consult, 2002; Hinton et al., 2003a; Veiga and Hinton, 2002).

a) Employment

Artisanal Mining is a global source of employment both formally and informally with Asia being the most significant region, followed by Africa and Latin America. Globally, artisanal mining employs over 13million people with Asia employing 7.2 million alone (ILO, 2003). Despite the reported employment, it is not clear whether employment returns are both sustainable and meaningful given the challenges that characterize the employment in this sector. For instance, China alone is estimated to employ over 3 million people in what are considered the world's most dangerous

mines, mainly the village level coal and gold mines that the state is constantly trying to close. ILO also estimates that close to 6,000 people die each year in China in the mines (ILO, 2003).

In Africa, artisanal and small scale mining employs over 4 million people directly and several millions indirectly. In Ghana, it is estimated that 30,000 people are employed within the legalized small-scale mining sector (World Bank, 1995), with the Minerals Commission and the Ghana Chamber of mines implying that 60 per cent of the country's total mining labour force is employed in small-scale and artisanal mines (Hilson, 2001). However, an additional 200,000 individuals are believed to be working illegally as artisans (Aryee 2003). In countries such as Brazil, Ethiopia, Tanzania and Zimbabwe, the number of illegal miners operating is also in the hundreds of thousands although employment statistics are notoriously difficult to capture given the nature of the mining (Hinton, 2001).

b) Does artisanal mining provide capital gains?

While artisanal mining is largely informal and being operated by the local and illiterate community members, the practice benefits more the well to do individuals with connections and purchasing power. Studies conducted indicate that it is, in fact, the more wealthy members of the community that are better placed to take advantage of the opportunities offered by Artisanal Small Scale Mining. For example, in Bolivia it was the landed members of the community that were able to engage in small-scale mining rather than the landless ones, who were unable to take the risks associated with employment in mining (Godoy, 1988). However, on the contrary, in Ghana, a detailed poverty and livelihood analysis of three communities that were engaging in

ASM (gold and diamond) found that artisanal miners were never at the bottom of the community's socio economical hierarchy. Food crop producers, rather than miners, were systematically ranked at the lowest levels (MIME Consult, 2002).

The analysis of capital gains from artisanal mining practice falls short of the understanding of the complex interplay between sustainable development pillars (i.e. Economy, Society and Environment) which are highly interconnected so much so that an imbalance in one causes a corresponding imbalance. Capital gains are thus not a singular measure of livelihoods improvement in the absence of other sustainable development parameters (NEMA, 2012).

c) Artisanal mining and Education

The involvement of large numbers of children in Artisanal Small Scale Mining is one of the illicit acts that characterize the sector and has been widely acknowledged and observed by several scholars (Drechsler, 2001; Jennings, 1999a; ILO, 1999; Martinez Castilla, 1999). Majority of the children start practicing in artisanal mining on a phased and part-time arrangement and gradually become fulltime thereby dropping out of schools. This poses a great risk to the future sustainability of livelihoods (Drechsler, 2001).

Labonne argues that the children's work in small-scale gold mining in Brazil is part of a family livelihood strategy, which parallels the socialization process that is noted in Africa (Labonne 2001). It was also found out, that in gold mining communities in Geita, Tanzania, it could be both a family livelihood strategy, mining being considered part of a particular lifestyle and a good opportunity for young people, but it could also be taking place where there is extreme impoverishment caused by family

breakdown, with for example divorcees or elderly relatives dependent on children bringing in an income (Mwaipopo et al, 2004).

d) Artisanal Mining and Agricultural livelihood

There is a strong linkage between artisanal mining and natural capital-the land resources. On one side, artisanal mining is seen to supplement and complement agriculture which is a major source of livelihood in most countries. On the other hand artisanal mining has been taken up as a coping mechanism in response to declining agricultural prices, droughts or depletion of natural resource stocks.

Additionally, the two sectors that is; agriculture and mining compete for same land resulting into land conflicts and related ills (Guinea, 2002). It is however, important to note that mining whether formal or informal, supports the wealthier that also have the capital to purchase food. Agriculture largely employs and supports the livelihoods of ordinary people who may not sustainably replace it with artisanal mining. It is thus not immediately clear whether complete engagement in artisanal mining by the local communities is not in fact livelihood insecurity (Guinea, 2002).

The study conducted by Mali provides important aspects of how communities can effectively engage in both mining and agriculture. The Mali report analyses how artisans can play around with *"agricultural calendar"* and use effective consultation and participation of communities to make balanced decisions without compromising on any. (Mali, 2002).

e) Does Artisanal Mining actually make a viable livelihood?

Artisanal mining practice is largely undertaken with a view to improve the livelihoods. However, vulnerabilities that characterize the practice tend to undo perceived and actual benefits of the sector. Studies indicate that the ability of artisanal mining to contribute to the long-term household security depends on a range of factors including; the type of ASM being undertaken, whether labour relations are exploitative, the number of household members involved, and relationship to other income generating activities at household level among others. For instance when an entire family is involved in the mining, it may be a survival strategy undertaken as a short-term solution to pressing needs but may compromise sustainable livelihood security of the entire household (Quiroga, 2002).

In terms of household security, "rush type" of migration raises concerns for (i) the family they have left behind (Hugues and Furamera, 1999) as well as (ii) the impact this will have on the households of the area where the rush-type mining has developed (Walsh, 2003). Concern has been raised for the high levels of consumption by miners in rush-type areas, especially on short-term "daring consumption" (Walsh, 2003) leisurely pursuits, such as alcohol, drugs and the provision of sexual services (Drechsler, 2001).

Research indicates that more mature and established mining sites appear to offer a more secure environment for the artisans. In a Mali report, it is noted that citizens of one particular village were described as "pure blood" alluvial miners who were less

reliant on agriculture, and had stronger social ties than more recently established mine sites (Mali, 2002).

Studies acknowledge the need to effectively identify and understand the driving forces for people's participation in the Artisanal Mining in order to guide the requisite interventions. For instance those driven by poverty with declining livelihoods options, are unlikely to countenance saving and investment in new technologies and will target mainly survival in which case, probably social protection programmes or basic health and safety guidelines would be a more appropriate intervention. On the hand, the formalized and legal artisanal mining has higher ability to improve livelihoods and require strengthening through appropriate technologies and strategies (Walsh, 2003)

1.3 Problem statement

Artisanal gold mining (AGM) is one of the emerging informal economic activities providing alternative livelihood options to thousands of people in the world with close to 25 million artisanal miners and about 150 million people indirectly reliant on AGM (ILO, 1998).

Uganda's gold industry has seen a radical increase in gold production and is currently over 7tonnes, up from 225kg in 1994 (MEMD, 2013). Gold appears to be widely distributed throughout Uganda, but has only been exploited by artisanal miners in a few areas near Busia (East), Buhweju and Kigezi (Southwest), Mubende (central) and more recently, Karamoja in the northeast. Unfortunately, a large proportion of the mining operations (90%) are still informal and unregulated with artisans using

rudimental methods of extraction which has not only affected the environment but has far reaching implications on their health and livelihoods (MEMD, 12).

Thousands of communities in Uganda are currently involved in "gold rushes" with a hope to improve their way of living. However, most artisanal gold mining practices take place in highly fragile ecosystems and agricultural fields with implications on people's livelihoods and ecology (Hinton, 2011).

Kinene, (2012) acknowledges that there is an emerging ecological and livelihood security challenge in Uganda associated with artisanal gold mining practices which are said to be on the increase in many parts of the country with thousands of local communities currently engaged in the mining practices. He notes that communities in the mining sites live in deplorable sanitary conditions, use toxic chemicals such as mercury in the gold extraction process and have severely degraded fragile ecosystems and agricultural fields that should support their livelihoods. Several reports including the media, have also warned of a looming crisis should the illegal and informal artisanal gold mining practices involving large communities in Uganda continue unabated (MEMD 2009, Kinene, 2013, NEMA 20012).

Despite this artisanal gold mining discourse, there is less scholarly work that underpins its critical implications on the livelihood security particularly discerning whether the perceived benefits in fact make meaningful contribution to the wellbeing and livelihood security of artisans. Several scholars have asserted that small scale informal mining practices have potential negative implications to livelihood security and ecology (Ocansey, 2013; Bastia, 2004 Montani, 2002; WFP, 2014; Maxwell 2002; Hutchion 2003; Alisha 2013; Frankenberger 1990).

The study thus seeks to explore the implications of artisanal gold exploitation on the livelihood security in selected districts in Uganda with a view to formulating best practice models for sustainable exploitation. It will also significantly inform the necessary policy interventions and actions and contribute to the body of knowledge.

1.4 General and specific objectives of the study

1.4.1 General Objective

To explore the implications of Artisanal Gold Mining practices on the livelihood security in Uganda.

1.4.2 Specific objectives

(i) To explore the nature of artisanal gold mining in Uganda;

(ii) To identify artisanal gold mining practices in Uganda;

(iii) To examine artisanal gold mining practices with significant implications on livelihood security;

(iv) To develop and evaluate a strategy for best practice artisanal gold mining in Uganda.

1.5 Research questions

(i) What are artisanal gold mining practices and processes?

(ii) What are the implications of artisanal gold mining practices on livelihood security?

(iii) How can artisanal gold mining be sustainably and safely undertaken?

1.6 Significance of the Study

Review of literature and the local experiences confirm that the number of people engaged in Artisanal Gold Mining in Uganda is enormous either directly or indirectly benefiting from it to provide alternative sources of livelihood (Kinene, 2012). As poverty continues to escalate, it is expected that more families and individuals are potentially likely to join artisanal mining and this will further narrow arable land, reduce environmental quality and exacerbate food insecurity problem. Further, with continued migration of agricultural labour to mining establishments, establishment of slums is bound to happen and subsequent challenges of disease outbreak, increased crime rate, increased birth rate, increased school drop outs among other are expected. This will not only worsen the food insecurity and poverty situation but may potentially lead to a complete socio-economic and ecological breakdown within the affected communities. Thus, an early insight into artisanal gold mining operations from the sustainability and livelihood point of view will help provide necessary policy alignment and also formulate a benchmark for addressing the entire informal mining discourse with a view to improving the livelihoods of communities engaged in the practice.

1.7 Justification of the study

There is a growing national concern regarding the massive involvement of local communities in the artisanal mining operations. However, the government still regards it as an illegal practice, providing no specific regulatory framework to guide the sector. Although there is a general understanding of the ecological and health challenges that come with the artisan mining practice, its potential spill over impact on the livelihood security is largely unknown.

The study will therefore significantly inform the necessary policy interventions necessary for sustainable exploitation of gold by communities and contribute to the body of knowledge.

1.8 Scope of the study

The study will be conducted in the two districts of Buhweju and Mubende located in the western region of Uganda. Specific study areas will be selected from the most affected sub counties of these districts. The study will focus mainly on investigating the nature of artisanal gold mining practices and how these practices affect livelihood security. Specific attention will be given to the households involved in the artisanal mining practices and some non-mining households for purposes of quality control.

The study will cover three main contents i.e. preliminary assessment and secondary data collection to fully understand the nature of artisanal gold mining context, field reconnaissance to assess various livelihood enterprises, understanding artisanal mining process and techniques used and finally undertake household and miners' survey to examine actual effects of artisanal mining on livelihood security.

1.9 Operational Definitions

Artisanal mining (AM) refers to mining by individuals, groups, families or cooperatives with minimal or no mechanization, often in the informal (illegal) sector of the market (Hentschel, 2003);

Food Security; Food and Agriculture Organization (FAO) defines Food Security as a situation which exists when all people, at all times, have physical and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life;

An ecosystem can be defined as "a topographic unit, a volume of land water and air plus organic contents extended in area over a particular part of the earth's surface for a certain time (Bailey, 1996);

Mining; is the extraction of valuable materials or other geological materials from the earth from an ore body, vein, seam, or reef, which forms the mineralized package of economic interest to the miner. Minerals can either be metallic or non-metallic, most economic minerals are metallic, while non- metallic minerals are mostly graphite, Diamond silicates, sand, gravel, mica marble, quartz etc.;

Minerals; refer to elements in their simple inorganic form. A mineral is generally defined as any naturally occurring substance of definite chemical composition and consistent physical properties;

Livelihood Security; A livelihood is a means of making a living. It encompasses people's capabilities, assets, income and activities required to secure the necessities of life. A livelihood is sustainable when it enables people to cope with and recover from shocks and stresses (such as natural disasters and economic or social upheavals) and enhance their well-being and that of future generations without undermining the natural environment or resource base (Chambers, 1992). Livelihood Security is therefore the means and processes to achieve sustainable livelihoods.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter provides a theoretical and conceptual background that help to define key theories and concepts on the complex relationships between artisanal mining and livelihood security. Particularly, the Social Model of Health theory helps to map the relationship between the individuals and their environment and how they interact for a sustainable living (Dahlgren 1991). The DPSIR concept helps to underpin the cause-effect relationships particularly, the driving forces, pressures, resultant state, impacts and responses required (EEA, 1998). The chapter also highlights key themes that characterize artisanal mining as well as the global and national artisanal mining perspectives.

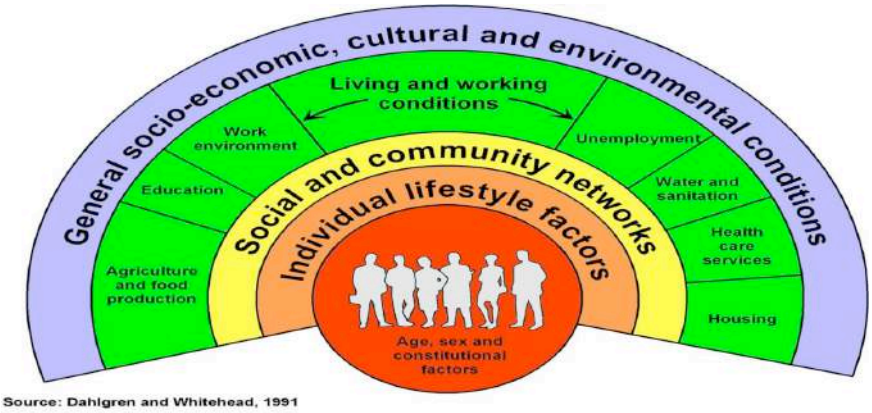
2.2 Theoretical review of Artisanal and informal Mining

2.2.1 The Social Model of Health

Dahlgren and Whitehead talk of the layers of influence on health. They describe a social ecological theory to health. They attempt to Map the relationship between the individual, their environment and disease and how these interact in a complex relationship (Dahlgren 1991). Individuals are at the centre with a set of fixed genes. Surrounding them are influences on health that can be modified. The first layer is personal behavior and ways of living that can promote or damage health e.g. the choice to smoke or not. Individuals are affected by friendship patterns and the norms of their community.

The next layer is social and community influences, which provide mutual support for members of the community in unfavourable conditions. But they can also provide no support or have a negative effect.The third layer includes structural factors: food security, housing, working conditions, access to services and provision of essential facilities which basically constitute their livelihood.

Fig.2



Source: Dahlgren and Whitehead, 1991

Living and working conditions include; Work Environment, Education, Agriculture and Food Production, Unemployment, Water and Sanitation and Health Care Services. It has been clearly demonstrated that the risk of disease and death cannot solely be attributed to genetic and physio-environmental factors, such as smoking, blood pressure, age and exposure to toxins, etc (Evans, 1994). Health and wellbeing is a result of the complex interplay between factors that include, but are not limited to, income level and disparity, social support networks, education, employment, working and living conditions, food security, physical environments, social environments, biology and genetic endowment, personal health practices, coping skills, healthy child development, health services, gender and culture (Evans, 1994; Health Canada, 2004; Marmot, 2001; Mach, 2004). These determinants function at an individual and collective level (Corin, 1994). Social determinants of health refer to both “specific

features of and pathways by which societal conditions affect health and that potentially can be altered by informed action" (Krieger, 2002).

Although these social processes and conditions are factors that "set certain limits or exert pressures", they are not necessarily deterministic (Krieger, 2002). Corin (1994) contends that the social determinants must be seen as a "network of interacting variables" which can exacerbate or mitigate health outcomes. Socioeconomic status and health are classically linked to behaviours or exposure to environments that place individuals at increased risk (Hertzman, 1994). Contemporary perspectives suggests that overall health can be attributed to a number of factors including nutrition, access to health services, degree of control over life conditions, and housing conditions, factors which may be lesser in lower socioeconomic groups and therefore increasing their susceptibility to various conditions.(Adler, 1994; Hudson, 1994; Mustard and Frank, 1994).

2.3 The Theoretical model of research

Considering various theories advanced by different scholars and the gaps therein, this research will be guided by the Social Model of health by Dahlgren and Whitehead. In this theory, the two attempt to map the relationship between the individuals, their environment and disease and how these interact in a complex relationship, a situation that is very well correlated with the artisanal mining-environment and socio-economic relationship. The theory thus relates well with how food production, availability and efficient utilization which can be viewed from the point of view of balancing sustainability pillars of society, ecology and economy as a means of ensuring livelihood support (Dahlgren, 1991).

2.4 Conceptual Review

This conceptual frame is guided by the Cause-Effect frame wok by Corvalán (1999), (Health, Environment and Sustainable Socio-Economic Development) as modified from the framework for the development of environmental health indicators, Briggs, 1996, (linkage methods for environment and health analysis).

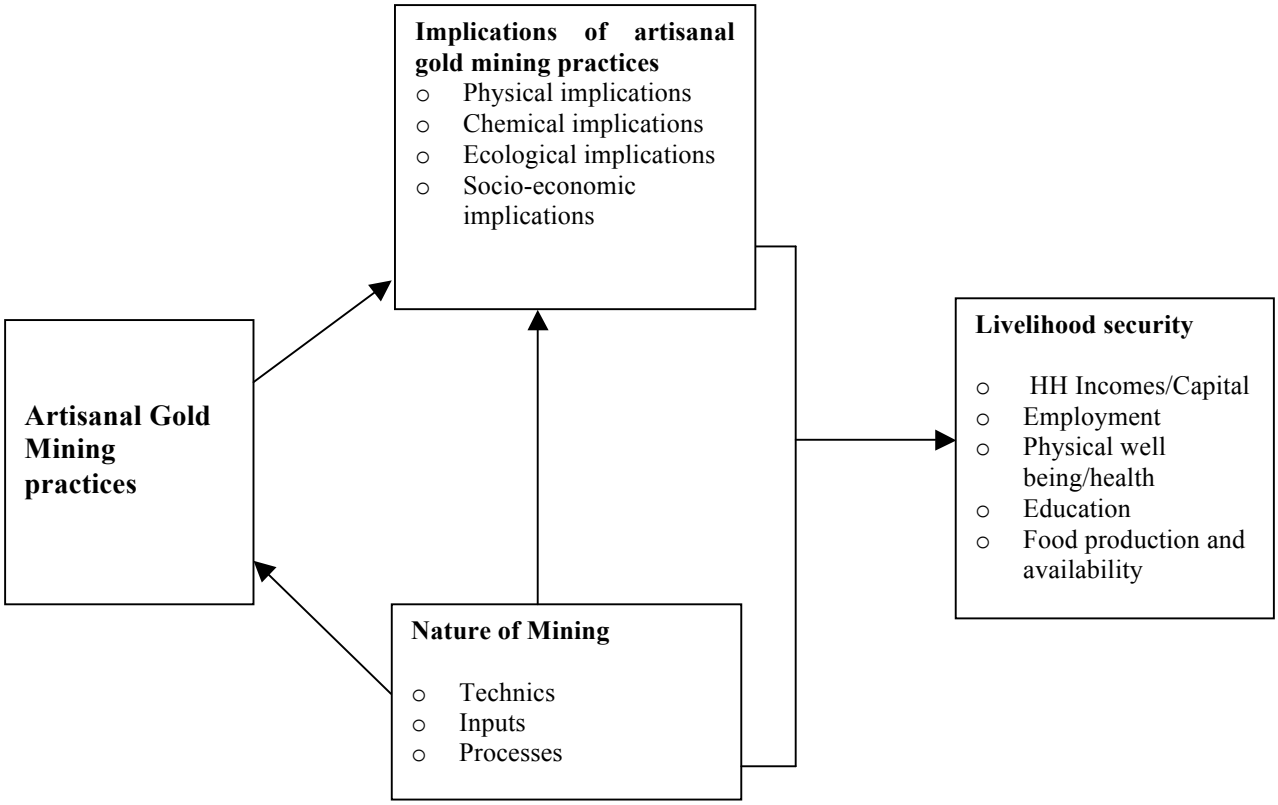
This frame work recognizes that the relation between human health, environment and socio-economic development is complex and requires holistic approach to fully address linkages and response mechanisms.

It further recognizes that there is no single best way of organizing and viewing the socio-economic-environment-health relationship that reveals all of the important interactions and possible entry points for response requirements thus focusing mainly on the driving force, resultant pressure, state, exposure, effect and the actions required. The framework for instance recognizes that although exposure to a pollutant or other environmentally mediated health hazard may be the immediate cause of ill health, the "driving force" and "pressures" leading to environmental degradation may be the most effective points of control of the hazard and this contrasts well with scenario where engaging in artisanal gold mining may have specific driving forces such as poverty, creates pressure on environment and will absolutely create end point effects on the livelihood security. Thus, in order to ameliorate the challenges of illegal/informal artisanal gold mining by the communities, it is imperative to link it to the concept of driving force-pressure-state-exposure-effect model (Cause-Effect Model).

Driving forces create the conditions in which artisanal mining can take place in pursuit of the basic necessities of life (food and shelter). Driving forces may include poverty or policies that determine trends in economic development, technology development, consumption patterns, and population growth. In this particular case, one of the driving forces may be poverty which pushes people into survival mechanisms such as the "informal gold mining" scenario paying little attention to their health, food needs and the need to preserve the environment. The driving force in turn generates different kinds of pressures on the environment, in such forms as waste from human settlements and depletion of agricultural lands or emission of pollutants from the mining operations.

These pressures can lead to changes in the state of the environment, as seen when land use is changed (deforestation or drainage problems) or when discharges of toxic chemicals or other forms of waste increase concentrations of chemicals in air, soil, water, or plants. The changes may have direct or indirect impacts on social economic and environment impacts and consequences such as food insecurity could be a result of this complex interaction. The conceptual framework in Fig. 1 therefore, highlights the important links between different aspects of society ("the why factor"/driving force), environment/natural resources (resultant pressures), the state, exposure and the possible effects and the desired outcome.

2.4.1 Conceptual Framework



Source: Adjusted from Corvalán, 1999: Cause-Effect Model

2.5 Thematic Review

2.5.1 Artisanal gold mining practices and their implications on livelihood security

Artisanal gold mining industry is motivated less by adventure and more by survival amongst the people with high levels of poverty. Poverty-driven miners rely on inexpensive, outdated, polluting technologies and chemicals such as mercury which has high environmental and health risks (Hinton, 2011).

Environmental Impacts associated with artisanal gold mining can detrimentally affect ecosystems through deforestation and the modifications of hydrologic systems, for

example, through silt accumulation in rivers or construction of water reservoirs (Akagi and Naganuma, 2000). Mining operations are generally destructive to the environment and can cause physical disturbances to the landscape, creating eyesores such as waste-rock piles and open pits. Particularly, surface mining requires large areas of land to be cleared so that the earth could be dug into by the miners causing harm to the environment and affecting arable lands thereby threatening food production (NEMA 2011).

The deforestation and land excavation during gold mining operations results into siltation of the nearby water sources through discharge of tailings into waterways, reduces light penetration and dissolved oxygen levels, thereby jeopardizing fisheries, and may result in flooding (Hinton, 2002). Deforestation can significantly impact women and families, due to the importance of forests for fuelwood and, sometimes, food and medicine. Akagi and Naganuma (2000) also identified deforestation as a major consequence of small scale mining.

In Rwamagasa Village, Tanzania, miners use timber from the nearby forest reserve to stabilize pit walls (Tesha, 2003). Prior to mining, the forest around Rwamagasa covered the entire region. At the current rate of forest extraction, Tesha (2003) anticipates that the forest will be completely decimated.

The environmental degradation associated with the excavation of large volumes of material can affect groundwater (when the water table is encountered), as well as water quality in adjacent drainages. Waste material is often heaped in close proximity to pits. This creates a source of silt which can be eroded by rainfall, clogging nearby

rivers. In Gugub Village, Sudan, Ibrahim (2003) estimated that 400,000 to 500,000 tonnes of waste and tailings are piled near pits. Siltation resulting from the erosion of mine waste and deforestation, coupled with the direct discharge of tailings into waterways, is one of the most significant impacts of mining on the environment (Hentschel et al, 2002). The effects of siltation from *garimpos* in Brazil, for example, can be observed as far as 300-500 km downstream in the Tapajós River (Carmouze et al, 2001).

2.5.2 Implications of Artisanal gold mining practices

Artisanal Gold Mining in most developing countries is still largely informal and unregulated and as a result, small-scale miners rely heavily on inexpensive, outdated, polluting technologies and chemicals chief among them mercury with high risks to human health and environment and these have a direct baring on the food production and access. It is reported that in humans, approximately 80% of inhaled mercury vapor is absorbed via the respiratory tract where it enters the circulatory system and is distributed throughout the body. Chronic exposure by inhalation, even at low concentrations in the range 0.7–42 μg/m3, has been shown in case control studies to cause effects such as tremors, impaired cognitive skills, and sleep disturbance in workers (WHO 1995).

The communities engaged in the mining operations face illness, injury and stress from dust and noise pollution, as well as extreme exertion from highly labour-intensive jobs (Hentschel et al, 2001). Although accidents are severely underreported due to its illegality, ILO (1999) states that non-fatal accidents in Artisan Small Scale Mining are still six to seven times greater than in the formal, large-scale mining operations. In

Mubende district, several people were reportedly killed by mining collapses in a single mining site (MDLG, 2013).

Chemicals like mercury, cyanide, sulfuric acid, arsenic and methyl mercury are used in various stages of mining. In order to amalgamate the extractions of minerals, toxic chemicals such as cyanide mercury, and other conditions such as oil, petroleum products, solvents, acids and reagents are used for refining process in order to leach and separate valuable minerals from other unwanted minerals. Siltation resulting from the erosion of mine waste and deforestation, coupled with the direct discharge of tailings into waterways, is one of the most significant impacts of mining on the environment (Hentschel et al, 2002).

One of the major community health risks associated with artisanal gold mining relates to water contamination, not only from mercury used in gold processing and metals leached from mine waste, but also from domestic wastes, such as sewage, detergents and other chemicals (Hentschel et al, 2003).

2.5.3 The role of artisanal gold mining on the livelihoods of the miners

The experience provided by several scholars indicate that artisanal mining sector if approached in a holistic manner that takes into account all socio-economic systems, it can become an instrument for development in the fight against poverty. The artisanal mining sector can thus serve as an economic anchor point for stimulating the development of complementary, sustainable, revenue generating activities. The revenues generated by the mining communities could allow for the emergence of small businesses which are well integrated into the local economic structure and

which contribute significantly to the sustainable development in mining communities (Hruschka, 2002).

2.6 The Empirical studies on Artisanal Gold Mining (AGM)

2.6.1 The global picture on artisanal gold mining

Artisanal gold mining (AGM) takes place throughout the world, but is particularly widespread in developing countries in Africa, Asia, Oceania, Central and South America (Hentschel, 2003). The global commissioned studies on Artisanal and small scale mining particularly those by the International Institute of Environment and Development (IIED) and the World Business Council for Sustainable Development (WBCSD) in over 20 countries provided a detailed overview of ASM sector with focus on social economic and environmental issues. The studies broadly highlight typical problems of AM related to Geology, Technology, Law, Human Resources, Marketing, Organisation and Financing mechanism but the sector's critical linkages to livelihood security are less explored (Hentschel et al 2003).

There are a number of international efforts and conferences focusing partially or exclusively on improving different aspects of artisanal mining and these include: the Calcutta 1991 conference at the National Institute for Small Mines, the Harare 1993 United Nations conference on important guidelines on small- and medium-scale mining, the Washington 1995 conference by the World Bank on comprehensive strategy towards Artisanal mining, the Vienna 1997 conference on Global Mercury Pollution from Artisanal Gold Mining and the Geneva 1999 Tripartite Meeting on Social and Labour Issues in Small-Scale Mines (IIED, 2003). However, most efforts have dwelled mainly on the geo-political and social economic environment of the sector with minimal focus on the sector linkages with livelihood security.

The study commissioned by Centre for Development Studies, University of Wales, Swansea assert that geographically, Asia, has the highest number of people involved in ASM but with the least ASM literature, compared to Latin America which has attracted a lot of attention despite the fact that fewer people are engaged in this sector. The centre's review indicate recent holistic studies on ASM, specific ASM aspects, environmental consequences, regulatory frameworks, and other technical issues but food security as a consequence of AGM is less explored (Gilman, 1999; Labonne and Gilman, 1999; Labonne et al., 2001; MIME Consult, 2002; Hinton et al., 2003; Malm, 1998; Veiga, 1997; Veiga and Hinton, 2002, Barry, 1996; Bugnosen, 1995; ITDG, 1990).

The Centre asserts that In-depth studies of Artisanal Mining communities are limited and this is further confirmed in other scholarly materials which indicate that a limited number of micro-level socio-economic studies have been carried out (Hughes and Furamera, 1999; MIME Consult, 2002; Heemskerk, 2000 and 2002; Walsh, 2003). The University further asserts that there are also few studies that capture the linkages between the micro and macro level in terms of the institutions, legal practices and policy processes that serve to exclude or include AS miners in decision-making that affects their lives including their socio-economic wellbeing and household food needs (CSD, 2004). The Centre alludes from the review of AGM scholarly work that the significance of AGM in people's livelihoods and how participation in the sector affects livelihood security and wealth creation including the sector contribution to poverty reduction in different contexts for different groups of people is not well understood (CSD-UW, 2003).

2.6.2 The National picture of artisanal gold mining

In Uganda, artisanal and large scale gold mining is one of the emerging forms of environmental degradation being experienced in different districts as shown on the map below. The rapid migration of a large population from the villages in search for gold is not only creating environmental challenges but has also severe health and socio-economic risks and the practices have potential impacts on the livelihood security of mining communities (NEMA 2012).

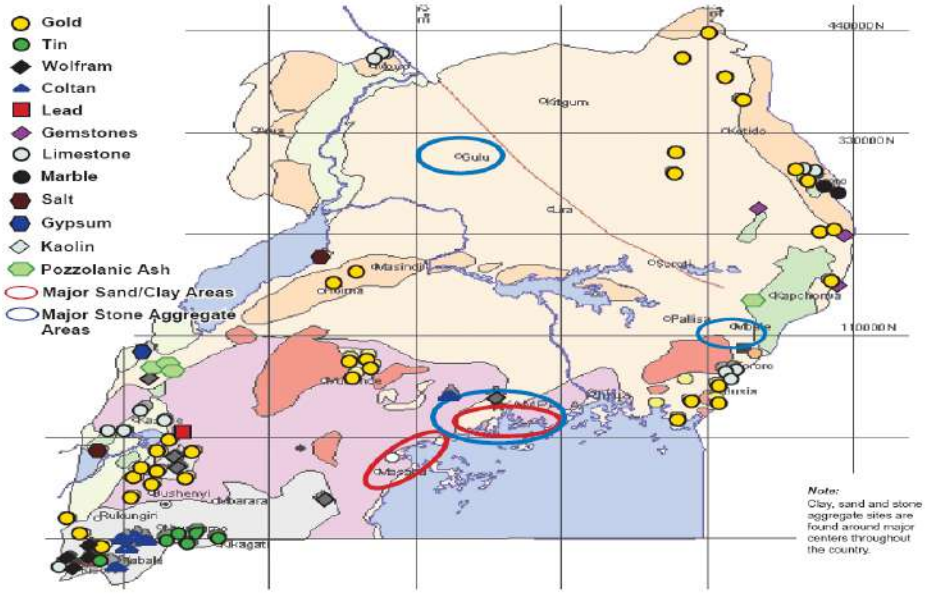


Fig. 3; Source: Hinton 2011(Gold mining sites in Uganda)

Most gold production in Uganda is by small producers who include licensed miners and artisans. Production statistics from artisan miners is only indicative given the fact that most operators are not licensed and even the licensed ones tend to under declare hence most of the gold is transacted through dubious channels (MEMD 2009).

The environmental degradation associated with the excavation of large volumes of material in alluvial fragile ecosystems particularly the wetlands has drastically affected the hydrological value of these ecosystems as well as the quality and quantity

of water in the areas affected. In Mubende District alone, over 3000 community members are actively involved in illegal gold and kaolin mining. The miners rely heavily on inexpensive, outdated and polluting technologies with high risks to human health and environment (MDLG, 2012). For instance, according to the monitor report of 10th November 2014, twelve people were killed and several others injured when a gold mine at Luginji mining site in Kitumbi sub county, Mubende district caved in. An avalanche of soil covered what was initially a 20 feet deep gaping hole where residents rummage for the gold. Over 1000 artisans are engaged in mining at this site (Daily Monitor, 10th November, 2014).

The sites mined in Uganda have differentiated ecologies raging from fragile aquatic areas to fertile agro-ecological zones and rocky areas and with the exception of Kisita, Kamalengera, Tira and Amonikakine mining sites, where gold is being recovered from reefs (hard rock), most of the gold is recovered from alluvial material and potential agricultural fields. Particularly, the gold mined in Buhweju is located in small, high grade alluvial deposits around the Proterozoic basin and in the wetland ecosystems making it highly risky to environment and human health (NEMA, 2013).

The rapid migration of a large population from the villages in search for gold is not only creating potential health and ecological risks but is also a recipe for social economic imbalances such as food insecurity, increased crime rate and prostitution with its related effects (NEMA 2013).

2.7 Synthesis of the Literature review

Although scholarly work on Artisanal Gold Mining (AGM) is substantial, there is less comparative connectivity to adduce the sector correlation with livelihood security. The scholarly materials on livelihood security have deeply analysed food security measurements, trends, impacts and the coping mechanisms with limited attention on how communities and individuals' engagement in other livelihood diversities such as artisanal and small scale mining could potentially impact livelihood security. The available analyses have limited quantifiable linkages between artisanal and small scale gold mining and the livelihood security (Montani, 2002; WFP, 2014; Maxwell 2002; Hutchion 2003; Alisha et al 2013; Frankenberg, 1990). Major attention of scholars has been mainly on geo-political, cultural, and ecological aspects of artisanal mining (Montani, 2002; WFP, 2014; Maxwell 2002; Hutchion 2003; Alisha et al 2013; Frankenberg, 1990);

The global commissioned studies on Artisanal and Small Scale gold mining (ASGM) particularly those by the International Institute of Environment and Development (IIED) and the World Business Council for Sustainable Development (WBCSD) in over 20 countries provided a detailed overview of ASGM sector with focus on social economic and environmental issues. The reports broadly highlight typical problems of ASGM related to Geology, Technology, Law, Human Resources, Marketing, Organisation and Financing mechanism but their linkages to livelihood security and agriculture are less explored (Hentschel et al 2003).

While ASGM is increasingly gaining recognition globally and more grounded in African countries like Uganda, it is still largely informal and illegal. further, its

linkages with livelihood security in terms of scholarship is scanty (Akagi, 2000). There are, thus, scholarly gaps on artisanal gold mining and livelihood security linkages particularly how this emerging shift in livelihood options could potentially impact on the livelihood security of the mining communities which makes this study important.

CHAPTER THREE

METHODOLOGY

3.1 Introduction to Methodological Approach

The primary purpose of this study is to examine a largely unknown phenomenon, particularly the implications of artisanal gold mining practices on the livelihood security. Recognizing the fact that, there is limited knowledge of artisanal gold mining in Uganda, more so its implications on the livelihood security, quantitative methods will be supplemented by a qualitative insight to provide significant understanding of the implications of community engagement in artisanal small scale gold mining on livelihood security.

3.2 Research Approach

Research approaches are plans and the procedures for research that span the steps from broad assumptions to detailed methods of data collection, analysis, and interpretation. A research approach is the way a researcher conducts his or research including the philosophies, the methods, techniques and strategies (Galliers, 1992). The study will follow the philosophies of design science research and adopt key principles of engaged scholarship and follow inductive hypothetical strategy.

3.3 Research Philosophy

Although philosophical ideas remain largely hidden in research, they still influence the practice of research (Slife & Williams, 1995). A research philosophy refers to the perspectives that researchers possess in the process of knowledge acquisition and development (Donnelly, 2007, March & Storey, 2008). Depending on the problem to be solved, the researcher may opt for different research paradigms.

This study will be guided by ***Design Science philosophy***. Design science is a "research paradigm in which a designer answers questions relevant to human problems via the creation of innovative and relevant artefacts" (Hevner and Chatterjee, 2010). Artifacts are models, methods, constructs, or instantiations designed to solve identified problems (Smith, 1995; Winter, 2008). The designed artifact helps to present the problem and provide its solution, it can also help to facilitate better understanding of the problem using specific constructs and abstractions, and the artifact can also help provide procedures for problem solving and can help demonstrate the feasibility of identified solutions through implementation (Winter, 2008).

Hevner (2007) presents three related and interdependent cycles in design science research; that is; the ***relevance, design and rigor cycle.***

The **relevance cycle** generates requirements from the contextual environment and introduces research artefacts. The **rigor cycle** provides grounding theories and methods, experiences and expertise from the knowledge base into the research and adds the new knowledge generated by the research. (March & Smith, 1995, Carlson, 2006; winter; 2008)

The **design cycle** allows the construction and evaluation of design artifacts and as solutions to the problem

Given research requirements, design science philosophy suits the study well. Particularly under the Relevancy cycle; the nature and process of artisanal gold mining will be explored and understood (research question one), under the Rigor cycle; the artisanal gold mining practices, theories and methods will be properly grounded and linked to livelihood security (research question two) and under design cycle; a model or framework for best practice artisanal gold mining will be developed and evaluated as a solution of the identified problem (research question three)

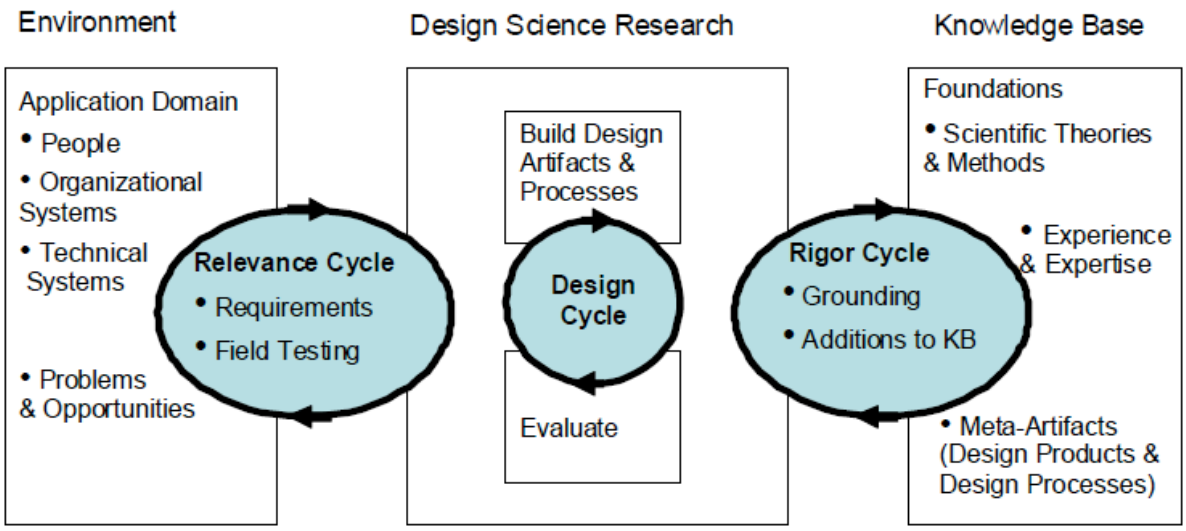


Figure 4: Design Science Research Circles (Source: Hevner, 2007)

In order to facilitate effective participation and inclusion of affected communities, **Engaged Scholarship** research philosophy will also be adopted to enrich design science principles with a view to provide requisite solutions to the problems of artisanal gold mining. Engaged scholarship is a participative form of research for obtaining the views of key stakeholders to understand a complex problem (Van de Ven, 2007). It is a participatory type of research which enables eliciting of

information from various respondents and expanding the scope of understanding of the phenomenon (science and practice) (Donnelan, 2012; Van de Ven, 2007).

Engaged scholarship also helps to expand the social, cultural, and human capital of local communities and facilitates attempts to understand and address social ills (Calderon 2007).The Diamond Model of Engaged Scholarship has four interrelated sides that facilitate problem formulation, theory building, research design and problem solving (*Fig.5*) and these have been well integrated in the research strategy of induction.

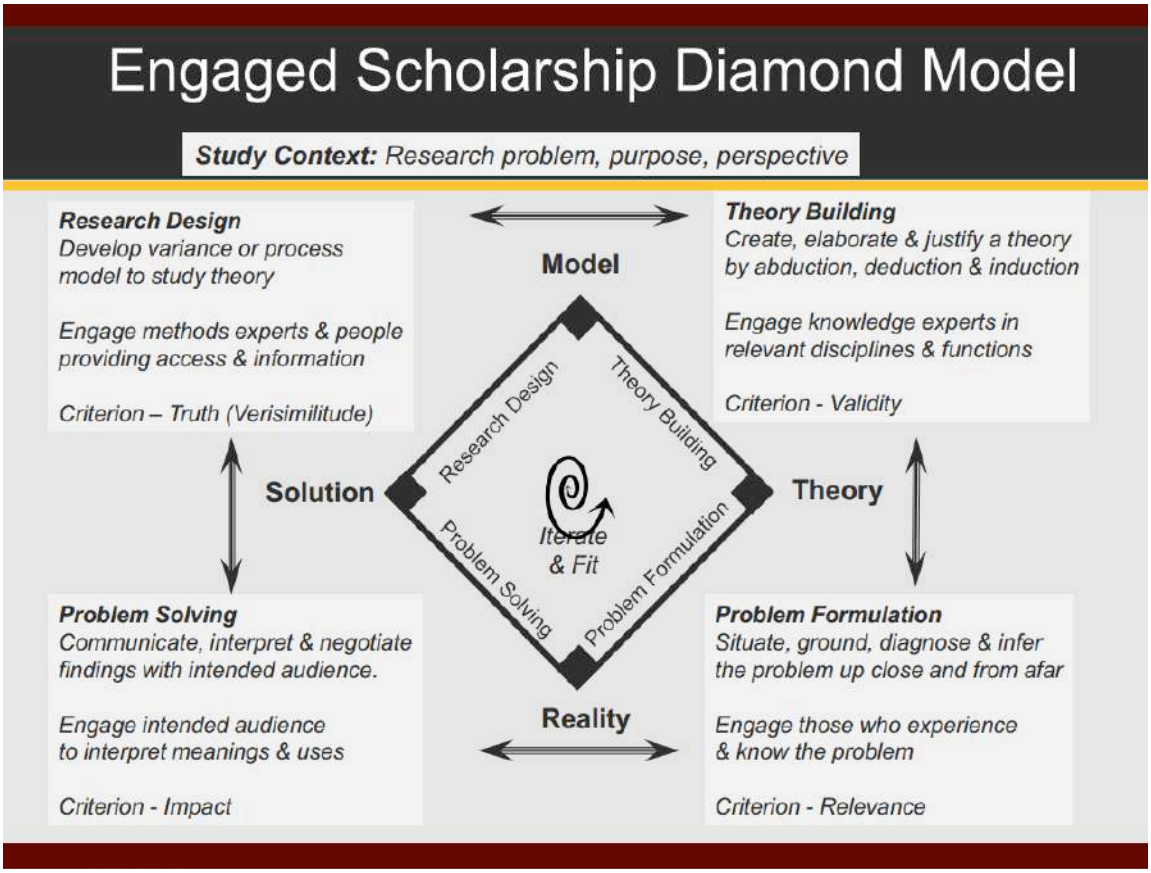


Figure 5: Diamond model of Engaged scholarship (Van de Ven, 2007)

3.4 Research Strategy

A research strategy is defined as a series of chronological steps followed when inquiring into the phenomenon being investigated (Trochim et al., 2007).

The inductive-hypothetical strategy (fig.6) will be used. The inductive-hypothetical research cycle (Sol, 1982) can be characterized as an early instantiation of Design science. The inductive-hypothetical cycle utilizes the problem-solving process as a means for research. The strategy takes real-life situations as the starting point for research. Characteristic for the inductive-hypothetical cycle are the various steps between the identification of problems and the formulation of solutions.

These steps further conceptualize the problem situation. Sol (1982) argued that a problem needs to be conceptualized and specified before it can be solved. It means that each step of the inductive-hypothetical cycle leads to the construction of specific model types that deepen the researcher's understanding of the situation.

The inductive-hypothetical model cycle consists of five steps namely; Initiation, abstraction, theory formulation, implementation, and evaluation (Churchman, 1971; Bosman, 1977; Sol, 1982; de Jong, 1992).

The model recognizes that the researcher enters a design situation with a set of preconceptions or a “way of thinking” that determines the way a problem is conceptualized. The researcher perceives the current situation through a lens (Keen & Sol, 2008) that distinguishes between essential aspects of the problem situation. That

lens reflects a basic choice with regard to “how and what to see in the world”. It guides the construction of a descriptive empirical model of the current situation that, just like a theory; is an interpretation of reality (Morgan, 1986).

The descriptive empirical model leads to the subsequent activity of Abstraction that further leads to a descriptive conceptual model that describes the mechanisms that explains essential aspects of the problem at hand. A description of these mechanisms is important for the subsequent research activities that mark a transition between descriptive towards prescriptive models. It stresses that finding mechanisms does not only satisfy the yearning for understanding, but also satisfies the need for control (Bunge, 2004).

The next phase of the strategy is the theory formulation which characterizes a change in orientation from problem definition towards problem solving, that is from descriptive towards prescriptive models. The aim of this phase is to find appropriate solutions for the problems that are conceptualized and specified during the previous two steps. They consist of a set of design guidelines that represent alternative solutions. The next phase of implementation makes the guidelines operational which results in a prescriptive empirical model or a set of actions that aims to change the current situation (Janssen, 2001).

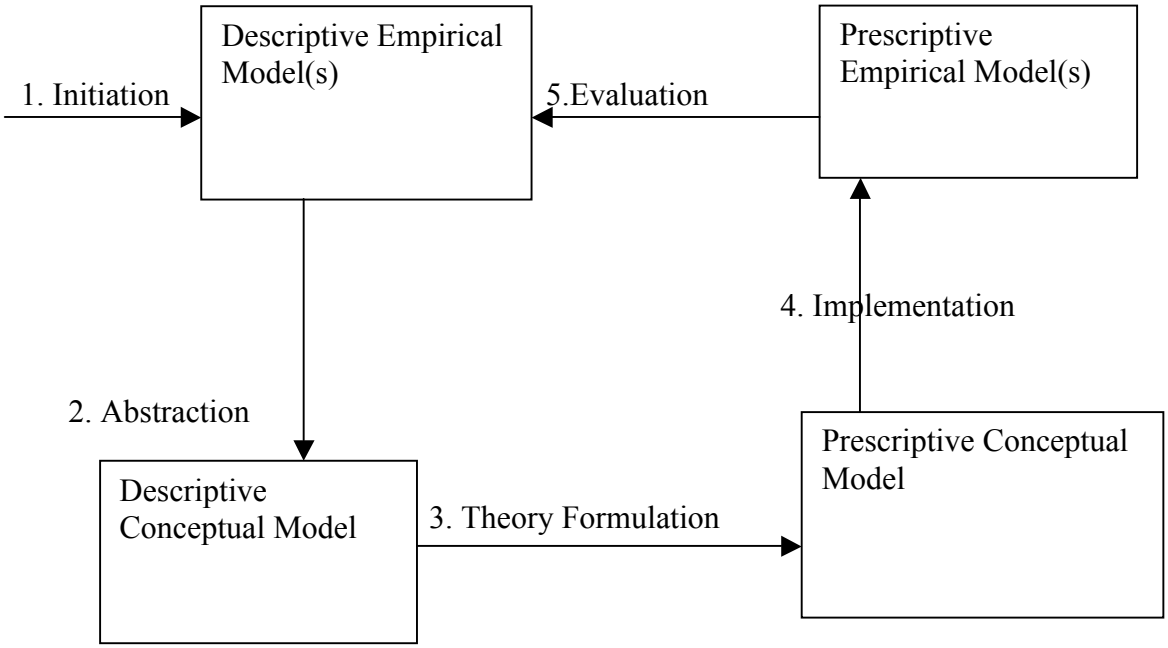


Fig 6: Inductive Hypothetical Research Strategy (Source: Sol, 1982)

In summary, the five steps of the inductive-hypothetical strategy will facilitate the study as follows:

Phase 1. Initiation phase: This phase is useful in gaining a clear understanding of the research problem (exploring the nature of artisanal gold mining);

Phase 2. Abstraction phase: The abstraction phase will help identify artisanal gold mining practices that affect livelihood security;

Phase 3. Theory formulation phase: The theory formulation phase will involve the process of the design which will result into development of a model for best practice artisanal gold mining;

Phase 4. Instantiation/Implementation phase: This phase will involve the implementation (pre-testing) of the best practice model derived from the theory formulation phase to facilitate sustainable exploitation of gold;

Phase 5. Evaluation phase: The developed best practice model will be evaluated and tested to ensure its effectiveness and usability in facilitating sustainable exploitation of gold by artisans.

3.5 Research Contribution

The study will be set out to examine the implications associated with artisanal mining practices on the livelihood security. The main contribution of the study will be a model or strategy designed for best practice artisanal gold mining to enhance sustainable utilization. Other than improving the artisanal mining operations through development of a model, the results of the study will also contribute to the body of knowledge and policy interventions.

3.6 Research Design

The study will follow Epistemological Positivism approach (Stahl 2003, Sol & Gonzales, 2012; Wynn, 2001) as well as exploratory design. Since the primary objective of this research is to examine a largely unknown phenomenon, particularly how artisanal mining practices affect the livelihoods of miners, an exploratory study will also be used. The choice of this design is to allow exploitation of a less known phenomenon, allow participation and designing of an artifact (strategy) as solution to the problem.

Based on the above design, the study will be conducted in four phases:

(i) The initial phase will look at artisanal gold mining from a macroeconomic context particularly focusing on its nature, legal and policy framework at a national level;

(ii) The second phase will involve a holistic case study of the targeted artisanal mining community based on qualitative data collection in response to the research questions set.

(iii) In line with the qualitative inquiry, a third phase involving a artisanal miners' survey will be conducted to better identify and ascertain the implications of artisanal gold mining practices on livelihood security;

(iv) The last and fourth phase involving selected community representatives will be held to critically review and or ascertain the earlier findings, fill the gaps and build consensus on key recommendations and follow up actions.

3.7 Study Population and Area

The targeted study population will be the household members and artisans involved in the artisanal gold mining in the districts of Buhweju and Mubende as well as registered mining rights. Particularly the categories of the population to be studied will include:

(i) Artisanal gold miners

(ii) Mining rights holders in Mubende and Buhweju

(iii) Other stakeholders within the gold mining sites

The study population will be comprised of 30 mining rights holds in Mubende, 21 mining rights in Buhweju, and a proportion of unlicensed artisans and other stakeholders in both districts (MEMD, 2013)

3.8 Determination of the Sample size

The sample size will be calculated using the Kish and Leslie formula of random sampling for single proportion. Expressed as

$N = \underline{Z^2\ Pq}$

d^2

N = Sample size

P =Estimated proportion of respondents, 50%

(Fong, 1995)

q = (1-p)

d = desired level of precision (acceptable error), $\pm$ 5%

Z =1.96 (95% confidence interval)

Therefore $N = \frac{1.96^2 \times 0.5 \times 0.5}{0.05 \times 0.05}$

$= 384$

Therefore, a total of 384 respondents will be involved in the study.

3.9 Sampling techniques and procedure

Sites and villages to be studied will be purposively selected from the study districts using Simple Random Sampling method. This will include;

(i) Obtaining a list of mining rights holders from MEMD and from the District Local Governments under study;

(ii) With the help Local Council Authority and artisanal miners, a proportion of artisans will be listed for interview

(iii) Possible adjustment of the sample size will be done to cater for non-response rates (Orobia, 2013)

3.10 Data collection methods

3.10.1 Focus Group Discussions: Focus Group Discussions containing 8 to 12 people will be conducted within the mining community where specific questions on the issues and subjects being researched will be discussed. The open and natural discussion format of focus groups allows for a wider variety of perspectives in a shorter period of time.

3.10.2 Observations: Physical observations will be conducted through direct visits to the artisan mining sites. This will involve taking photographs of the affected ecological sites.

3.10.3 Surveys: Surveys allow the researcher to gain information from specialists in a field that we are less qualified or knowledgeable in for example if we need to have information on key scientific parameters and chemicals. This will involve asking broad open-ended questions that are designed to receive large amounts of content, providing the freedom for the experts to demonstrate their knowledge.

3.10.4 Documentary Review: Several documents will be reviewed to provide insight into artisanal gold mining practices. These may include; reports on the subject matter, scientific reports by scholars and legal documentation as well as media and documentary clips.

3.11 Research Instruments

Research instrument that will be used to aid the data collection methods will include; Focus Group Discussion Guide, Survey Questionnaires, observation checklists, interview guide, transcription tapes, video tapes, and cameras.

3.12 Pre-testing/quality control (Validity and reliability)

3.12.1 Reliability

This is the degree to which an assessment tool produces stable and consistent results while Validity refers to how well a test measures what it is purported to measure. There are several types of reliability and these include; test- retest, parallel forms, inter-rater and internal consistency. For purposes of this study, a test-retest method of reliability will be used. Test-retest reliability is a measure of reliability obtained by administering the same test twice over a period of time to a group of individuals. The scores from Time 1 and Time 2 can then be correlated in order to evaluate the test for stability over time. Pretesting will be done to determine Cronbach's alpha; above 0.7; (Vogt, 2007 and Bougie, 2013);

3.12.2 Validity

Although reliability is necessary, it cannot be sufficient alone. Thus for a test to be reliable, it also needs to be valid. Validity how well a test measures what it is purported to measure (Vogt, 2007; and Bougie, 2007). There are several types of validity such as face validity, construct validity, criterion-related validity, formative validity and sampling validity. For the purpose of this study, Sampling Validity will be used. Sampling Validity is important because it ensures that the measure covers the broad range of areas within the concept under study. This is because not everything

can be covered, so items need to be sampled from all of the domains. This may need to be completed using a panel of "experts" to ensure that the content area is adequately sampled. Additionally, a panel can help limit "expert" bias (i.e. a test reflecting what an individual personally feels are the most important or relevant areas), (Cozby, 2001).

3.13 Procedure of data collection

The procedure for collecting data under this study will be informed by the study design selected and from whom to collect the data. The procedure will involve plans for the collection including meetings with data collectors and other stakeholders, acquisition of introduction letters, obtaining Consent and administration of survey questionnaires and collection of completed questionnaires.

3.14 Data Analysis

Qualitative Data Analysis: Notes from the research assistants and transcripts from the tape records will be compared, gaps filled and a concise versions written out. The content and the emerging themes will be recorded. The data will be analysed using the descriptive master sheets. Quotations will be used to keep the original concepts of the answers given. All data collected from various sources will be triangulated during the analysis to complement, increase validity and check the oversights. The results will be presented in terms of narrative text and quotes.

Quantitative Data Analysis: At the end of each day, data collected will be sorted, checked for consistency and for completeness. Open-ended questions will be categorized. After all data has been collected, it will be entered into SPSS/ Epi Info

(***Version to be decided***) software package and exported to Stata 8.2 software for analysis. The analysis will be done in stages:

(i) Univariate analysis- where frequencies of variables will be generated and tabulated in line with the objectives;

(ii) At bivariate level/analysis, cross tabulations will be constructed to establish the associations between variables of interest;

(iii) At multivariate analysis, all variables that will have been statistically significant at bivariate analysis will be subjected to the multivariate model to control for confounding;

(iv) The strengths of the association between variables will be determined using odds ration and 95% confidence intervals.

3.15 Measurement of variables

Variables will be measured using classification into categories, numbers, ranking and description (Healey, 1993) as well as the use of Likert five-point scales (1-5 for strongly disagree and strongly agree).

REFERENCES

1. Akagi. (2000). *Methyl mercury Accumulation in Amazonian Inhabitants Associated with Mercury Pollution: Workshop on Human Health Effects of Low Dose Methyl mercury Exposure.* Japan: National Institute of Minamata.

2. Aryee. (2003). *Small-scale mining in Ghana as a sustainable development activity:* Its development and a review of the contemporary issues and challenges.

3. Barry. (1996). *Regularizing informal mining - a summary of the proceedings of the international roundtable on artisanal mining*. World Bank: Industry and energy.

4. Barreto. (2008). *Analysis of Artisanal and Small-scale Mining Mongolia Regulations for Gold.*

5. Barnes, R. (2009). *Property Rights and Natural Resources.*

6. Bugnosen, E. (1995). *A preliminary assessment of small-scale mining legislation and regulatory frameworks.* DfID Project: 'Policies for Small-Scale Mining.

7. Bugnosen, E. (2001). *Country Case Study on Artisanal and Small-Scale Mining: Mining, Minerals and Sustainable Development (MMSD) Project.* London: International Institute for Environment and Development (IIED).

8. Calderon, J. (2007).*Race, poverty, and social justice: Multidisciplinary perspectives through service learning*.

9. Cozby, P. (2001). *Measurement Concepts. Methods in Behavioral Research.*

10. Drechsler, B (2001). *Small-scale mining and sustainable development in South Africa*

11. Fabian. (2011). *Property Rights Theory and the Reform of Artisanal and Small-Scale Mining in Developing Countries.*

12. Gilman. (1999). *Artisanal mining for sustainable livelihoods*. UNDP.

13. Godoy. (1988). 'Small-scale mining and agriculture among the Jukumani Indians, Northern Potosí, Bolivia', *Journal of Development Studies*, vol.24, no.2, pp.177-196.

14. Hentschel. (2002). *Global Report on Artisanal and Small Scale Mining. Minerals and Sustainable Development Project.* IIED and WBCSD.

15. Heemskerk. (2000). *Gender and gold mining: the case of the Maroons of Suriname*, Working Paper No.269. Michigan State University: WID Programme.

16. Heemskerk. (2002). '*Livelihood decision making and environmental degradation: small-scale gold mining in the Suriname Amazon.* Society and Natural Resources.

17. Hinton. (2003) '*Women and artisanal mining: gender roles and the road ahead. The socio-economic impacts of artisanal and small-scale mining in developing countries*.

18. Hinton. (2009). *National Strategy for the Advancement of Artisanal and Small Scale Mining*.

19. ILO. (1999). *Social and labour issues in small-scale mines: Report for discussion at the Tripartite Meeting on Social and Labour Issues in Small-scale Mines*. Geneva: Sectoral Activities Programme.

20. ILO. (2003). *Facts on Small-Scale Mining*, *Sustainable Development at Work.* World Summit on Sustainable Development.

21. ILO. (1999).Social and Labour Issues in Small-Scale Mines: www.ilo.org/public/english/dialogue/sector/techmeet/tmssm99/tmssmr.htm.

22. Jennings, (1999a). *Child labour in small-scale mining: examples from Niger, Peru, and Philippines*: Working Paper, Sectoral Activities Programme, Industrial Activities Branch, SAP 2.78/WP.137, ILO: Geneva.

23. Long. (1995). *Economics of Mining Law. Natural Resources Research.*

24. Labonne. (2002). *Harnessing mining for poverty reduction, especially in Afric*a. Natural Resources Forum. vol.26.

25. Labonne. (1999). *Towards building sustainable livelihoods in the artisanal mining communities*. Geneva: Tripartite Meeting on Social and Labour Issues in Small-scale mines.

26. Malm. (1998). *Gold mining as a source of mercury exposure in the Brazilian Amazon, Environmental Research.*

27. MIME. (2002). *Poverty eradication and sustainable livelihoods: Focusing on artisanal mining communities.*UNDP/DESA.

28. MDLG. (2013). *Environmental Challenges of Artisanal Gold Mining. Mubende District Local Government.*

29. Veiga. (1997). *Mercury in artisanal gold mining in Latin America: Facts, Fantasies and solutions*. UNIDO Expert Group Meeting: Introducing new technologies for abatement of global mercury pollution deriving from artisanal.

30. Veiga. (2002). *Abandoned artisanal gold mines in the Brazilian Amazon*: a 'legacy of mercury pollution".

31. Veiga. (1998). *Artisanal Gold Mining Activities in Guyana*. Vienna: United Nations Industrial Development Organization.

32. WHO. (1995). *Inorganic Lead. Environmental Health Criteria, No. 165.* Geneva: World Health Organization.

33. Walsh. (2003). *'"Hot money" and daring consumption in a northern Malagasy sapphire-mining town'*. *American Ethnologist,* vol.30, no.2, pp.290-305.

34. WBCSD. (2003). *Artisanal small scale mining: International Institute for Environment and Development.*

35. World Bank. (2012). *Artisanal Mining in Critical Ecosystems:* a look at Gabon. Liberia and Madagascar.

APPENDECES

Appendix 1: Work plan

Activity	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S
Finalize Research Proposal																
Defend the proposal																
Collect data																
Analyze data																
Write dissertation																
Write and publish journal articles																