AN ASSESSMENT OF THE EFFECTS OF ARTISANAL MINING IN TABAKA, KISII COUNTY, KENYA

By

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C50/88846/2016

A research project submitted in partial fulfillment for the award of Master of Arts Degree in Environmental Planning and Management at the University of Nairobi.

UNIVERSITY OF NAIROBI

2021

DECLARATION

This research project is my original work and has not been submitted to any other institution for an academic award.

13/7/2021

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This project has been submitted to the University of Nairobi with the approval the University supervisors.

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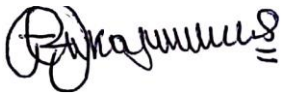

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Signature Date

DEDICATION

I dedicate this project to my loving spouse Veryl Anita and lovely daughter Gabrielle Rumbe, loving parents Sammy Rumbe and Teacher Dorine Rumbe, Sister Molly Rumbe, and Brothers George Rumbe and Geoffrey Rumbe.

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LIST OF ABBREVIATIONS AND ACRONMYS

AIDs: Acquired Immunodeficiency Syndrome

ASGM: Artisanal Gold Mining

ASM: Artisanal Small-Scale Mining

GDP: Gross Domestic Product

GEO: Group on Earth Observations

GST: General System Theory

HIV: Human Immunodeficiency Virus

IIED: International Institute for Environment and Development

ILO: International Labor Organization

LSM: Large Scale Mining

NACOSTI: National Commission for Science, Technology and Innovation

NEMA: National Environment Management Authority

NMFM: Ngoyla-Mintom Forest Massif

SDGs: Sustainable Development Goals

SPSS: Statistical package for Social Sciences

SSA: Sub-Saharan Africa

UK: United Kingdom

UN: United Nations

ABSTRACT

Soapstone is a soft soapy rock that comes in a variety of colors due to leaching of different minerals across them. It is used in making sculpture, cooking pots and in structural architectural applications. Nevertheless, soapstone mining has social, economic and environmental effects. Its mining leads to landslides and soil erosion hence reduced productivity. Also, the mining of soapstone brings changes to the physical outlook of the landscape, river siltation, and reduction in soil productivity and massive landslides during the rainy season. To ensure the sustainability of mining in Kenya, it is important to understand and assess the social-economic and environmental effects of soapstone mining. The main objective of the study was therefore to assess the effects of artisanal mining, Kenya. The specific objectives were; (i) to establish the nature and extent of artisanal mining (ii) to examine the socio-economic effects of artisanal mining (iii) to assess the environmental effects of artisanal mining recommend ways to ensure sustainable artisanal mining. The study was hinged on a descriptive research design. The target population of interest was 1200 individuals working in Tabaka soapstone mining, the area chief, public health officer in Kisii County, an officer from the Ministry of Petroleum and Mining, the head of Energy, Water, Environment and Natural Resources Department in Kisii County Government, the head of trade and industry department, the head of Health Services department and the head of National Environment Management Authority (NEMA) in Kisii County. Both primary and secondary data were used in this study. Simple random sampling was used to select 300 individuals working in Tabaka mines and purposively selected the public official for in depth interviews. Further, semi-structured questionnaires were used to collect primary data. This study generated both qualitative and quantitative data. The quantitative data in this research was analyzed by descriptive statistics and inferential statistics using Statistical Package for Social Sciences (SPSS version 22). Descriptive statistics included frequency distribution, mean (a measure of central tendency), standard deviation (a measure of dispersion) and percentages. The data was then presented in tables, charts and graphs. Content analysis was used in processing qualitative data and the results were presented in prose form. The study also used Spearman Rank-order correlations analysis to check for the level of the association between the independent variable (artisanal mining) and the dependent variables (socio-economic effects and environmental effects). Regression model was used to ascertain the degree to which the independent variable predicts the dependent variable at 95% significance level. It was found that there is significant socio-economic and environmental effects of artisanal mining in Tabaka. From the findings, the study recommended that the National Government of Kenya should open up factories such as the terrazzo to make use of the resources and create more jobs for the people. Further, the County Government should give clear regulations to control activities of soapstone industry. The residents and the community members should form groups and cooperatives to avoid exploitation by middlemen and the regulatory institutions should conduct sensitization on good mining practices for sustainability.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background of the Study

Soapstone is a unique soft soapy rock, whitish to creamy whitish that comes in a variety of color and striation because of the leaching of different minerals across them. Its soft property allows to cut easily with a knife and can be shaped like wood at the same time can be extracted in big blocks of more than 2 cubic feet.

Mining entails extraction of valuable materials from the earth by humans for economic and industrial development for both export and local use. Globally, mining has taken place since ancient times and used not so differently. In Norway, this soft metamorphic rock with heat-resistant properties has been used to make vessels, pots and even architectural features for structural building (Storemyr and Heldal, 2002). Souza *et al*. (2016) presents that it is significant in the promotion of the Brazilian economy used as a raw material in the craft industry, although this activity generates a significant amount of waste. This shows that majorly soapstone is used for handicraft and thus it is important to have value addition strategies to minimize on the waste while the same time gain maximum profit from the stone (Rodrigues, 2012).

Mining of minerals and exploitation of minerals is an important strategy to propel the world towards achieving 2030 Sustainable Development Goals (SDGs). For example, Goal Number One on poverty eradication: which is to end poverty in all its forms can be attained with the contribution of minerals, which facilitate the manufacturing industry and create employment opportunities hence enhancing the supply chain of mineral products. However, mining of mineral products, if not controlled may have a negative effects both environmentally and socially which might hinders the achievement of some SDGs. These effects include climate change, access to clean water and good health.

Artisanal and small-scale mining (ASM) is defined differently around the world. However, all revolve around similar characteristics of a low-technology, labor-intensive mineral extraction process Bakia (2014). This is what distinguishes ASM and Large Scale Mining (LSM), since the LSM is characterized by low-labor and highly mechanized processes of mineral extraction.

However, as obsolete as the ASM techniques may seem, it is significant to mention that they are primarily the most optimum the miners can employ given their challenges, such as lack of finances for better resources and equipment (Buyeke, &Njoroge, 2015).

Globally, there have been studies that have looked at the socio-economic and environmental effects of artisanal mining. Guenther (2018) observed that some of the socio-economic effects of mining in India included prostitution, which facilitated the spreading of HIV/AIDs; criminal activities expected to create fear and increased level of poverty. He also noted that a significant environmental impact was water pollution and air pollution in the area as a result of the open cast type of mining and evident destructive tailings channeled into rivers and streams. Friedman and Miles, S. (2012) in a study in Canada observed that mining facilitated land degradation due to abandoned tunnels after mining, eroded gullies and sites that encourage criminal hideouts was a common social effect and poor or low pay in the artisanal mining sector was a common economic impact.

In Africa, Chandiwana (2016) in a study in Ghana observed the common social effects of artisanal mining as facilitation of family breakages since most of the miner spend most of their time in mining sites and rarely bother to go home furthermore mining facilitated sexual harassment of ladies by their male mining partners who are supported by both the authority and the mine owners. Economically, the workers and consequently the community got little money out of the business while environmentally; there were massive air and water pollution. Bakia (2014) on his part in looking at socioeconomic and environmental effects of artisanal mining in Morrocco observed a positive effect socially by noting that the mining contributed to national and local income; an increase in export and GDP that led to poverty reduction. Also, it created business and job opportunities in some industries as a result of economic and market growth. They, however, realized reduced economic stimulus from mining as a result of the prevalence of non-resident workers, income inequality.

In Kenya, approximately 146,000 people engage in artisanal mining. The mining activities take place in various parts of the country. These include areas such as Mbeere and TharakaNithi which are well known for gemstone and industrial mining. Gemstone mining also takes place in the coastal region while gold mining takes place in areas like Kakamega, Migori, Trans Mara and Narok counties. In Kisii, specifically Tabaka area, mining of soapstone and carving is often a

business managed by families where the mines are located who most of the time prefer to sell their products personally although some have formed groups for selling their finished products. They do this as a way to avoid exploitation from middlemen who buy the stones and artifacts cheaply and later sell them at exorbitant prices. For example, they can offer 2,000ksh for a 40-tonne lorry worth of stone (World Bank, 2019).

Buyeke and Njoroge (2015) noted that ASM is strongly linked to poverty and is a major livelihood option in the rural settings that provides the rural population with an opportunity to better their social-economic status. Despite this huge potential to elevate locals from poverty, the mining of soapstone still is not devoid of other negative factors. Rop (2014) presents that ASM effects the people and the environment in several ways, for instance, injuries and death in mining sites due to collapsing of the tunnels resulting from the use of explosives, Biodiversity loss as a result of vegetation clearing and failing to rehabilitate the areas in times of prospecting and mining, shortage in water supply due to increased usage in addition to water contamination.

According to Fisher *et al*. (2019), Friedman and Miles (2012) and Funoh (2014) they based their discussion on the resource curse theory. The theory argues that countries with natural resource abundance tend to be behind in terms of economic development and democracy as compared to countries with fewer or less natural resources. In all the studies that they conducted, they argued that most of these countries tend to be in constant conflict over the same resources thought to be a blessing to them. Due to this school of thought, this study analyzed if the soapstone in Tabaka can also be an empirical study based on the same theory.

1.2 Statement of the Problem

Soapstone is a mineral found in different part of the world. In Kenya, it is majorly found in Tabaka region in Kisii County. It is used in making sculpture, and in architectural applications like floor tiles, countertops, interior surfacing and shower-bases. Owing to its fire-resistant characteristic, soapstone is used in making cooking pots and fireplaces. It also attracts tourists as it can be carved into different artifacts and the local people use it for home decorations.

This industry has however been resilient to external forces providing a livelihood to the locals in Tabaka(Akama, 2018) and continues to be the most notable income activity practiced in the area. Soapstone has helped in growing the economy of both the country and the locals by encouraging

foreign exchange (Obwori, Iravo, Munene, & Kaburi, 2012). Despite the aforementioned benefits one would expect that Tabaka region would have flourished and developed since mining begun in this region more than a century (since 1885) ago. However, the reverse seems true as the region lacks socio-economic growth. A view through Tabaka main trading center shows slow housing development among other social infrastructure.

Also, the mining of soapstone brings changes to the physical outlook of the landscape, river siltation, reduction in soil productivity and massive landslides during the rainy season. Understanding and assessing the socio-economic and environmental effects of soap stone development is important for the sustainability of mining in the region.

Research done on ASM in Kenya has focused mainly on gold mining in Migori (Odumo, *et al.* 2011), gemstone in Taita Taveta (Rop, 2014) and stone mining(Wells, 2000) just to mention a few. However, as Zvarivadza (2018) suggests that the mining effects and challenges of mining minerals are always not identical, hence it is (disastrous) to assume that the issues encountered in other ASM sites are transferable to soapstone mining in Tabaka region. Studies on ASM have focused more on the tourism (Njoroge, 2015; Obwori, *et al.* 2012; Ogembo, 2015) and its history, evolution, and development (Akama, 2018) with little consideration of environmental issues. The purpose of this study was to assess the socioeconomic and environmental effects of soap stone mining around Tabaka.

1.3 Research Questions

1. What is the nature and extent of artisanal mining in Tabaka, Kisii?
2. What are the socio-economic effects of artisanal mining in Tabaka, Kisii County?
3. What are the environmental effects of artisanal mining in Tabaka, Kisii County?

1.4 Research Objectives

1.4.1 Main Objective

The main aim was to assess the effects of small-scale mining in Tabaka, Kisii County.

1.4.2 Specific Objectives

The study focused on the following specific objectives:

1. To establish the nature and extent of artisanal mining in Tabaka, Kisii County.
2. To examine the socio-economic effects of artisanal mining in Tabaka, Kisii County.
3. To assess the environmental effects of artisanal mining in Tabaka, Kisii County.

1.5 Research Hypotheses

H_{01}: Artisanal mining has no significant socio-economic effects in Tabaka, Kisii County.

H_{02}: Artisanal mining has no significant environmental effects in Tabaka, Kisii County.

1.6 Justification of the Study

Soapstone is a natural resource in the environment. In Tabaka ward mining of soapstone is the most practiced economic activity. Due to low employment rate in the Country, artisanal mining has been an alternative for many people as a means of getting income to cater for their basic needs.

Firstly, the research benefits the local community as it provides knowledge on how soapstone mining affects their social, economic and environmental well-being and provides recommendations for dealing with various arising issues.

The research avails information on the potential and challenges of artisanal soapstone mining that needs attention to enable maximize its output in the area. It is key to the County Government of Kisii in planning and policy. To the regulatory authorities, the study sought to provide clarification on the perception of environmental effects resulted from soapstone mining and suggest ways of reducing the effects.

For National Government, it offers data on the effects of artisanal mining on socio-economic and environmental conditions of a population and a region that can be used to make better environmental and poverty-friendly decisions and policies. The study enriches the body of knowledge on the influence of artisanal mining on the environment and the social economy. In addition, it provides information which can be used as research material, in identifying

knowledge gaps and providing a basis on which further studies can be done on the effects of artisanal mining in different regions of the world.

1.7 Scope of the Study

The survey was done in Tabaka, Kisii County. It borders the Sub-county of Masaba South on the northern side, Rongo Sub-county on the western side, the Sub-county of Trans Mara West on the southern side and Gucha South Sub-county on the eastern side. The research focused on soapstone mining activities in Tabaka area, Kisii County, which has the largest soapstone deposits in the Country. Because of its unique geology of availability of soapstone in the area, the area was fit for the study. The mining of soapstone in the area is historical and culturally rooted in the community and hence an activity that has been there since time immemorial. The study focused on the miners, craftsmen and the surrounding. Though, some miners double in as craftsmen too. Specifically, the target population was 1200 individuals working in Tabaka soapstone mining, the area chief, public health officer in Kisii County, an officer from the ministry of mining in Kisii County, the head of Energy, Water, Environment and Natural Resources department in Kisii County government, Trade and industry department and the head of National Environment Management Authority (NEMA) in Kisii County. Survey was undertaken in March to June 2020.

1.8 Limitations of the Study

Getting data of the artisanal miners was a challenge since there is no database containing the exact number of artisanal miners mining from those mines. To however counteract this, the researcher went to the study area and manually got the real miners.

The study area is in a rural setting and most of the miners can only communicate in their local vernacular. The researcher used a translator who helped translate and capture respondent information to facilitate data collection and analysis.

The biased information of respondents was experienced as some felt that they were being investigated. However, respondents were guaranteed with proof of research permit, that the information gathered was purely for academic use only.

1.9 Definition of Terms

Soapstone: A unique soft soapy rock, whitish to creamy-whitish that comes in a variety of color and striation because of the leaching of different minerals across them. Its soft property allows to cut easily with a knife and can be shaped like wood at the same time can be extracted in big blocks of more than 2 cubic feet.

Artisanal and Small Scale Mining (ASM): This is the exploitation of minerals with the use of primitive methods and tools such as hoes, axes and shovels

Artisans: These are groups or individuals depend on mining for living. They use basic tools and techniques like chisels, shovels and hoes to exploit their minerals.

Artifacts: Objects sculptured or made by artisans from the soapstone. These are usually of historical interests such us tools, animals and other work of art made for aesthetics and for selling

Socio-economic Effects: These are direct or indirect effects to the artisanal mining on Infrastructure provision, migration of labor, Squatters, Health, Income, Job creation, poverty reduction as well as other social factors like commercial sex, HIV, alcoholism, and school dropout.

Environmental Effects: This refers to the effect of artisanal mining activities on the environment leading to destruction of vegetation, mining waste, and generation of solid wastes as well as pollution of water, soil and air.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Introduction

This chapter presents review of the literature on the effects of artisanal mining. It begins with an empirical review followed by the theoretical framework, conceptual framework, and a summary of research gaps.

2.2 Artisanal Mining

ASM is strongly linked with poverty and is a major livelihood option in the rural settings that provides the rural population with an opportunity to effect on their social-economic status (Hruschka & Echavarria, 2011). These can be categorized into four types (1) Permanent ASM where the mining activities are practiced full time and it is the major income-generating activity which sometimes is complimented by agriculture,(2) seasonal ASM is where the mines are active when other activities are dormant, (3) Rush type ASM: suggests that newly discovered minerals are perceived to have greater returns than the present gains and lastly (4) Shock Push ASM: where issues such as loss of employment make one join the mining activities as a way to ease the shocks.

The mining activity can be either legal or illegal furthermore; it can be formal mining or informal mining. Artisanal mining is associated with the short-term mining plan, but no long term plan besides the mining activity is done through rudimentary techniques (Kipsang, 2015). An artisanal miner is the person involved in subsistence mining and not hired officially by a mining firm but uses his or her resources to independently mine various resources or pan for gold. In small scale mining, capital intensive methods are not adopted, however, firms or individuals hire people for mining purposes whereby the manual intensive methods are adopted, working with hand tools which include hoes, chisels and shovels. O'Neill &Telmer, (2017) indicate that these artisanal miners adopt rudimentary techniques when extracting minerals furthermore; repeatedly, they work in risky areas, employing hard manual labor, highly disorganized and illegal conditions. However, artisanal mining has been advantageous to many families in most of the developing world as it provides employment opportunities where there are limited economic activities (Kipsang, 2015).

Globally, there are around 20–30 million artisanal miners. At least three to five times this number is dependent on mining activities indirectly. Furthermore, 10-15 million individuals are specifically engaged in artisanal gold mining (ASGM) activities. Worldwide, over 80 countries practice artisanal mining, which contributes to about 15 percent of the total gold mined globally, 80 percent sapphire, 20 percent diamond, 60 percent of the total mined tin, 50 percent of the total produced tantalum, and 80 per cent of the total-colored gemstones (World Bank 2019). Apart from the mentioned export minerals, artisanal mining also plays a significant role in availing other domestic industrial minerals like coal together with other construction materials used locally.

According to estimates by the International Labor Organization (ILO) 1999, 13 million miners were directly involved in ASM activities with dependents of about 80 -100 million people globally and the number seems to be on the rise. The rise is linked to factors such as an increase in prices of minerals and difficulties in securing jobs to earn a living from other alternative livelihoods like agriculture. By 2014 the number had grown more than twice hitting almost 30 million (Nguyen, Boruff & Tonts, 2018). This is evidence that the number of people indirectly depending on artisan mining is approximately 150 million Obiri *et al* 2016). However, the number of people associated with ASM varies worldwide. In 2009, the number of miners in most African countries was approximately 5–20 percent of the total population; while in Latin America the total miners were approximately 0.1–5 percent of the total population; and in Asia, the total number involved directly in artisan small scale mining was 0.1–1 percent of the total population (Maarifa, Mwikamba & Hamida, 2016).

ASM is essential in the socio-economic sector for the poor rural communities in several developing countries, many of whom have limited alternatives for providing a living for their families (Meth, Mueller & Maedche, 2015). Over 90 percent of the world's mining workforce is artisanal mining. In over 80 nations, the total number of men, women, and children benefiting directly from the mining sector is estimated to be 40.5 million. Recently, ASM has experienced tremendous growth in most areas of Sub-Saharan Africa. Though estimations differ, there is unanimity that at roughly 35–45 percent of the households in rural sub –Saharan Africa generate their income from the ASM sector (Kipsang, 2015).

2.3 Social Effects of Artisanal Mining

Obiri et al (2016) assessed the social effects of ASGM concerning livelihoods of communities in the Municipality of TarkwaNsuaem, Ghana and found that 59% of men dominated mining operations. Moreover, mining operations do not need a highly skilled workforce and, as a result, most miners had few or no education. Largely, this contributed to school dropouts in the area as children went to work in the mines. Ibrahim (2015) established that child labor in ASM sites in Sudan was on a decline as the presence of children in mining sites was minimal.

The participation of children in mining activities is categorized as one of the "worst forms of mining". This refers to work that can harm or have a negative, undesirable effect on the children's social, physical, mental health which needs to be eliminated. These activities include children digging underground, carrying heavy loads and handling hazardous materials. The exact population of children engaged in ASM is difficult to find since their participation and practices are mostly illegal and informal, therefore, practiced in secrecy, making it hard for conclusive research to be undertaken (Schipper, De Haan, & Van Dorp, 2015).

In the African setting, working in the mines with parents is considered a normal household activity just as agriculture and taking care of siblings (Potter & Lupilya, 2016). Most of the ASM activities are done as a family with the boys joining their parents in hard labor while the girls join their mothers in providing support services and doing lighter jobs in the mines. Most form their careers in ASM activities.

A combination of household poverty, cultural issues, and rural poverty make the children get involved in mining activities (Jønsson & Bryceson, 2017). Therefore, most work in mines to augment the household income. Their engagement is not necessarily forced, but sometimes voluntary (Potter & Lupilya, 2016). The mine owners however take advantage of them by overworking them and paying them less with an excuse that they are doing them a favor by letting them work in the mines. ASM provides the rural poor with an opportunity to earn and fund their education and at the same time enhance their livelihood hence it is detrimental to apply international child labor laws which are based on western culture, without putting into consideration the African context to which this activity occurs (Maconachie & Hilson, 2016).

Estimation of women's involvement in SSA is averagely 50% of the total mining population (McQuilken, 2016). Just like their counterpart the men, due to lack of alternative employable skills, engage in ASM for survival (Bansah, Sakyi-Addo, & Dumakor-Dupey, 2016). Women are more engaged in ASM than in LSM because of high mechanization in the LSM sector, which bar them due to lack of skills. Most of the women engage in service activities such as food and are sometimes not rendered as miners which have led to them being marginalized (Lu, 2012). However, their role cannot be ignored and considering them as stakeholders in planning and operations will make ASM reach the potential of having a sustainable socio-economic and environmental development.

Women are generally more considerate of their households more than men. They engage in mining activities to sustain their lives and those dependent on them (Bansah, *et al.,* 2016). Most of their income is channeled into the support of household expenditures like food, clothing, and health care (Blair, *et al.*,2017). A study in Cameroon by Bakia (2014) found that women would give their portion of their earnings to the support in paying school fees when their husbands had not yet earned income from the mines. Men as well admit that women working in the mines are beneficial to the whole household and reduces the pressure of providing for the household (Buss *et al.,* 2017)

The social structure in rural areas where the mining takes place plays a vital role in how women are viewed. By engaging in ASM activities, they get a chance of earning a living and in turn gain respect and viewed differently by the community. In the Wolframite mines of Rwanda, the women in mining were viewed just as those in other jobs such as teachers and nurses. This empowers women and reduces the social ills in a community (Buss, *et al.,* 2017). Economic stability gotten from mining activities has made women diversify into other economic activities. Some have managed to save and raise capital for other sources of income even though their earning is way less than the men in mining. For instance, a Ugandan woman who started as a food vendor used her profits to buy land which she used for agriculture and real estate business in the neighboring mining site (Buss, *et al.,* 2017).

Rural settings are guided by norms and taboos. These are always different from one community to the other. Mostly, women are viewed as weaker beings and most taboos prohibit them from accessing the mining areas during certain periods terming them as unclean and bad luck to the

success of the mines. Men working in tin mines in Uganda say that this makes it hard for women to have a say in mines and hence miss out on the well-paying lucrative jobs being given lighter duties such as washing, crushing and packing. Ogembo (2015) found that the majority of women work on polishing and washing soapstones compared to 3% in the excavation. 29% percent of women compared to 10% worked in support services such as food vendors and domestic services.

Community and family pressure concerning their gender duties mostly dictate the engagement of women in mining activity. Women work fewer hours directly than men do. However, research in the Philippines by (Carstens, Lozano, Runge, & Nguepjouo, 2017) found that women worked 12 hours compared to men's 11 hours hence 1 hour more both directly and indirectly than men. The idea that women's primary duty is to care for their families is a disincentive to fully engage in mining.

ASM comes with social changes that affect the community. These changes can be brought by migrants or a change of culture by the local people. Cases of increase in promiscuity have always been on the rise in areas where mining activities occur. (Huesca Jr, 2013).

Shoko and Mwitwa (2016) investigated the social effect of ASM on local community residents in Zambia and revealed that Lufwanyama district lacks enough secondary school infrastructures and health facilities. It was found that the district has one high school and small health centers with very few beds for admitted patients. However, the place has no referral health center. The research showed that students and the sick cover long distances to access education as well as health care. As a result of the poor transport system, there has been minimal service delivery in the education, health and agricultural sector. The study further found that there is poor quality education and high illiteracy level, which has been facilitated by long distances and inadequate learning resources. There is unsustainable education and literacy level; this is a result of inadequate schools, low-quality education, limited learning resources and an increased rate of school dropouts. This implies that small-scale emerald mining had no considerable impact on the social characteristics of the community. Mutono (2016) studied the social influence of Macalder mines in Migori County, Kenya and found ASM to be the most widely practiced subsistence activity in the region. However, there was no relationship between occupation and illness (Chest infections, miscarriages, tuberculosis, anemia, and malaria).

2.4 Economic Effects of Artisanal Mining

ASM catches the attention of those economically unstable and vulnerable rural and urban populations displaced by economic hardship seeking an opportunity for economic stability (Hruschka & Echavarria, 2011). The communities involved are categorized into occupational communities, indigenous communities and residential communities. Occupational refers to those residents who rely on mining for their income, while residential are those living within the areas where mining is done and indigenous are those that have a traditional cultural attachment to the mining areas. However, these three are not mutually exclusive for instance, indigenous may mine thus becoming the occupants and also migrants may come and be occupants even though their residents are far.

It has contributed to the increase in employment, wealth creation and also alternative livelihoods in countries such as Ghana, supporting approximately more than 4.5 million people in the region (McQuilken, 2016). ASM is by far the largest source of employment in the surrounding mining community. Approximately 146,000 people in 2012 were estimated to be involved in ASM in Kenya. However, getting a specific number of people involved is somehow difficult given its informal and unregulated nature and use. Rop (2014) estimates the total number of those, directly and indirectly, dependent in gemstone mining in Taitataveta to be 2,684 and 19,344 respectively. This shows that it is a viable economic activity in this specific region and has great potential in building the region economically.

ASM has proved to be a viable non-farm complementary economic activity. It provides a short time between working and earning compared to agriculture where one has to wait for a long period, facing numerous risks that might affect their output for instance drought and attack from pests and diseases. Therefore, it supplements the smallholder farm produces. This was evident in Indonesia, where 70% of farmers were also involved in the mining of manganese to supplement their income and buy farm inputs and other non-farm activities (Fisher *et al.,* 2019). Their involvement was during periods where farming activities were silent. The mining activity provides money for local revenue and hence boosts the local economy by providing services and equipment to sustain the mining (Hruschka & Echavarria, 2011). However, the Macroeconomics of ASM is mostly ignored as the owners remain in poverty while the national economy gains.

This has mostly been attributed to the middlemen who take advantage of the locals by buying the stones at a cheaper price and sell them much more expensive (Buss, *et al.,* 2017).

In Cameroon, Funoh, (2014) revealed that those involved in mining earn at least of XAF 80,000 (US$ 160) which is almost thrice the mean salary of a Cameroonian (XAF 28,216 or US$ 56) an amount up to XAF 800,000 (US$ 1600) on a monthly basis. Through excavation, the residents are in a position to provide for the basic needs, afford education and access health care. According to the miners, mining is their best option since no tax involved, no requirement, and no credit transactions unlike other activities like agriculture. The survey too found that artisanal mining is quite considerable in terms of economic gains since it increases the business activities within the mining fields and in the residential area at large. In Zambia, Shoko and Mwitwa (2016) revealed that too much dependence on small scale emerald mining has put a challenge to the maturation of the rural regions. Furthermore, findings revealed that the growth of the rural areas has been hampered by the inadequate distribution of employment opportunities as well as an unfair distribution of resources from mining activities. Similarly, Tsurukawa, Prakash and Manhart (2013) carried a study along the societal influence of artisanal cobalt mining in Katanga, DRC and found that estimates of 67,000 to 79,000 people are permanently employed. When mineral demand is high, the employment rate hikes up to 90,000 to 108,000 employees.

In Ghana, Obiri*et al* (2016) assessed the economic influence of artisanal mining on the residents in the TarkwaNsuaem county council and found that most firms dealing with mining accommodate the experienced employees to take over the position that was to be filled by Ghanaians. Of the 15 per cent of the region's population, 10 per cent reported that their parents worked for mining companies; 10% of those miners were fired by mining companies and engaged in illegal mining for their basic needs. In Sudan, Ibrahim (2015) researched on the economic influence of artisanal mining. The research relied on secondary data and the findings revealed that artisanal gold mining activities currently contribute 85% of gross domestic product. It was indicated that 12 to 15% of the domestic product came from LSM and agriculture.

In Kenya, UKAid (2018) reports that the gold mining industries, taking into account other counties like Siaya and Turkana, employs approximately 40,000 Kenyan citizens. At the same time gemstone mining employs an approximate of 30,000 miners. It points to the essence of the

ASM sector, which employs approximately 140,000 people. In Migori, ASGM is the main economic activity, though farming is often practised in parallel with mining. In the communities around Osiri, gold mining is the major source of inceome and 78% of miners have no consideration to leave the mines anytime soon. This can likewise be observed in gemstone mining in Taita Taveta. It is not strenuous for both men and women to access employment in the mining sector; moreover, the sector is more beneficial as compared to factory farm.

2.5 Environmental Effects of Artisanal Mining

People's perception of the environmental effects caused by ASM is informed or misinformed by their understanding and importance they give to the environment (Funoh, 2014). Some view it negatively and those do not perceive any environmental effects caused by the mining activities. The most regrettable natural consequences, such as fragmentation of the soil and rich biodiversity loss, are majorly linked to dynamic and abandoned mines. These issues arise because of ignorance to ecological functions of the environment.

According to Rodriguez (2012), soapstone mining in Ouro Petro region in Brazil contributes positively to enhancing the economy of the area. However, they noted that it left a huge amount of waste in terms of rock debris and powder, which was carelessly, discarded causing environmental issues. To minimize this they came up with a way to add value to the waste and used the powder for insecticide, used in paper industry and encouraged the miners to sell the waste powder to get more profits from the waste material.

Deforestation makes the land bare and prone to soil erosion hence land degradation. Miners cut down trees around the mining areas for fuel used in their mining activities and create space for excavation. This decreases the productive potential of the land and hence increasing vulnerability of the population by increasing the rate of food insecurity (Djibril *et al.*, 2017).

In Ethiopia, Admasu (2015) revealed that while mining of stones was a worthwhile economic activity in the semi-urban zones of Addis Ababa, it affected the environment through environmental degradation. Haule *et al.* (2016) found that most of the soil erosion and vegetation depletion in the region of Mbeya in Tanzania was due to mining activities. Chandiwana (2016) discovered that environmental conflict arose due to scarce natural resources such as water and land. Most of the disagreements between the authorities and the miners were fueled by illegal

artisanal mining in Zimbabwe. Regulators also had a task to ensure economic gain and at the same time maintain environmental integrity.

Obiri *et al* (2016) revealed that the rate of water pollution has increased as a consequence of excavation in the Tarkwa Nsuaem Municipality in Ghana. As such, most of the traditional water sources had been contaminated and was not fit for human consumption and also a decline in farmland as mining activities increased in the area. Similarly, Guenther (2018) indicates that from an environmental perspective, both ASM and LSM cause forest cover loss in Ghana. Results suggested that overall; deforestation is significantly higher in ASM- than non-ASM areas in Ghana.

In Kenya, Ogembo (2015) utilizing quantitative and subjective strategies for research resounded that regardless of stone mining being the boss monetary supporter of a dominant part of the family unit in the County of Mandera, it had then again deteriorated the earth in equivalent measure. Waweru and Mukundi (2015) comparably in an alternate report in Kiambu province of Kenya discovered stone mining to have monetary gains while the same time was detrimental to the environment by polluting water bodies hence affecting the health of the domestic animals and people.

In Rongo Constituency, Mwango (2010) indicates that open-pit artisanal gold mining has a detrimental impact on the environment and the negative effects are already being felt as the water bodies are being contaminated and widespread land degradation has contributed to the siltation of rivers Migori and Kuja. In Migori County, Mutono (2016) indicates that the Macalder mines had unacceptable levels of lead and arsenic in both soil and water samples, creating an occupational risk for the mine workers. Also, levels of lead in River Kuja were above acceptable levels in both soil and water samples. Arsenic had acceptable levels in the water, but unsafe levels in the soil samples.

Abandoned mining pits without reclamation or even refilling the pits act as a breeding ground for mosquitoes and risky to animals and eventually no vegetation grows around the area (Funoh, 2014). Besides, several indigenous trees and shrubs were found to be cleared to create space and provide raw materials for building shelters for the miners in TaitaTaveta (Rop, 2014). If this trend continues, there will be a major biodiversity loss in the ecosystem. In Tabaka, men are majorly the ones doing the mining by use of hoes, shovels, machetes and axes. The pits are dug

up approximately 5 to 30 m deep and the diameter of 50 to 70 meters wide to extract the soapstone (Kinyua et al., 2011). Their work, nevertheless, did not tell if there was any rehabilitation of these pits after excavation.

ASM has always been pictured as an activity that has major environmental implications. However, this is not always the case as it depends on the mineral being mined and techniques used. The mining of manganese has caused very minimal negative environmental issues Indonesia which were easily reversible (Fisher *et al.*, 2019). They suggest that issues should be tackled on case by case basis since so many factors are in play while undertaking the activities.

2.6 Theoretical Framework

The study was based on resource dependence and stakeholder theory. This is because all mining activities can be considered a system, and the success and benefits of the ASM are highly dependent on stakeholder management.

2.6.1 Resource Dependency Theory

Pfeffer and Salancik developed this in 1978. This is a study of how external resources, like the organization's raw materials, influence the organization's behaviour. Resource acquisition and management are important principles of strategic and tactical management in all organizations. The first basic argument in resource dependence theory is that organizations are resource-dependent (Hruschka and Echavarria, 2011).

The livelihood and development of a community depend on physical and financial resources as well as human capital resources. In Tabaka, financial resources are obtained from the artisanal mining activities and selling of soapstone. Secondly, argument of the theory is that these resources are ultimately derived from an organisation's environment (Buss, et al. 2017). Thirdly, 66that the environment, to a larger extent, contains other organizations that provide a variety of suppliers hence making sure that one organization does not rely on a single source of external resources like raw materials. The mining of soapstone in Tabaka is regulated by organizations such as MENRA, NEMA and most of the products are transported to the main cities in Kenya including Nairobi and Mombasa (Kenya National Bureau of Statistics, 2018). The fourth argument is that resources are the basis of power. Financial resources emanating from soapstone

mining activities provide the community with purchasing power that can improve their lives (Shoko &Mwitwa, 2016).

This study used the resource dependency theory to explain how artisanal mining leads to positive social and economic effects in a Tabaka community. The use of artisanal mining has provided jobs in Tabaka, thus helping the community members to improve their livelihoods. While artisanal mining leads to negative effects, including commercial sex, alcoholism, and conflicts among the youth, it also led to positive effects that include infrastructure provision, income generation, job creation, poverty reduction and expansion of industrial and commercial activities.

2.6.2 Stakeholder Theory

Stakeholder theory was developed by Mitroff in 1983. It states that an organization succeeds only when it benefits its stakeholders, and the advantages of the firm come in a wide variety beyond the expected benefits. Stakeholders cover a wide variety of beneficiaries which includes; the local community, buyers, sellers, investors, government and foreigners who contribute to the achievement of an organization (Miles, 2012).

The general concept is the understanding of the different components with varied interests regarding what the organization should be and how it should function. Friedman and Miles (2012) argue that the company should be designed as a cross-section of stakeholders with and that the objective of the organization and management should be focused on managing their needs, wants and perspectives. Again, Freeman (1984) noted that management of the firm should not only promote the benefit of its stakeholders in ensuring their rights and involvement in every stage of decision making, but also acts as the stockholders' agent to ensure and safeguard the survival and long-term stakes of the firm and each group.

Miles (2012) emphasize the idea of stakeholder, or managing stakeholders or approaches to managing stakeholders, suggesting that managers ought to articulate and ensure implementation of processes and activities that satisfy stakeholders. The primary aim of this process is to ensure management and integration of the relationships and interests of shareholders, the communities, the employees, customers, suppliers as well as other relevant groups in a manner that ensures and guarantee the future success of the organization (Mitchell, Agle&Wood, 2017).

The socio-economic and environmental effects of artisanal mining depend considerably on the relationships and management of various stakeholders. Being more of a big business chain where people earn a living and also the government getting revenue from it, this theory is appropriate for this study as it involves all stakeholders either as the change-makers or the affected pool in the socio-economic and environmental aspects of artisanal mining in Tabaka. Stakeholders in artisanal mining include the miners, craftsmen, National Environment Management Authority (NEMA), Ministry of Petroleum and mining, Environment and Natural Resources department in Kisii County and consumer of products from soapstone. However, as inclusive as this theory may be, the main shortcoming is that it majorly concentrates on the human participation and less on ethical issues such as effects on the natural environment (Orts & Strudler, 2002). An increase in artisanal mining without pro-environment regulation leads to degradation of environment thus negatively affecting society. Also, a good management relationship between miners, craftsmen, and customers ensures increases in activities, which include an increase in mining, products, and sales.

2.7 Conceptual Framework

The intention of this research was to study how ASM in Tabaka affects the community and environment. The independent variable in this research is artisanal mining. The dependent variables include socio-economic and environmental effects. The hypothetical association of the independent and dependent variable categories (socioeconomic and environmental effects) is as shown in Figure 2.1.

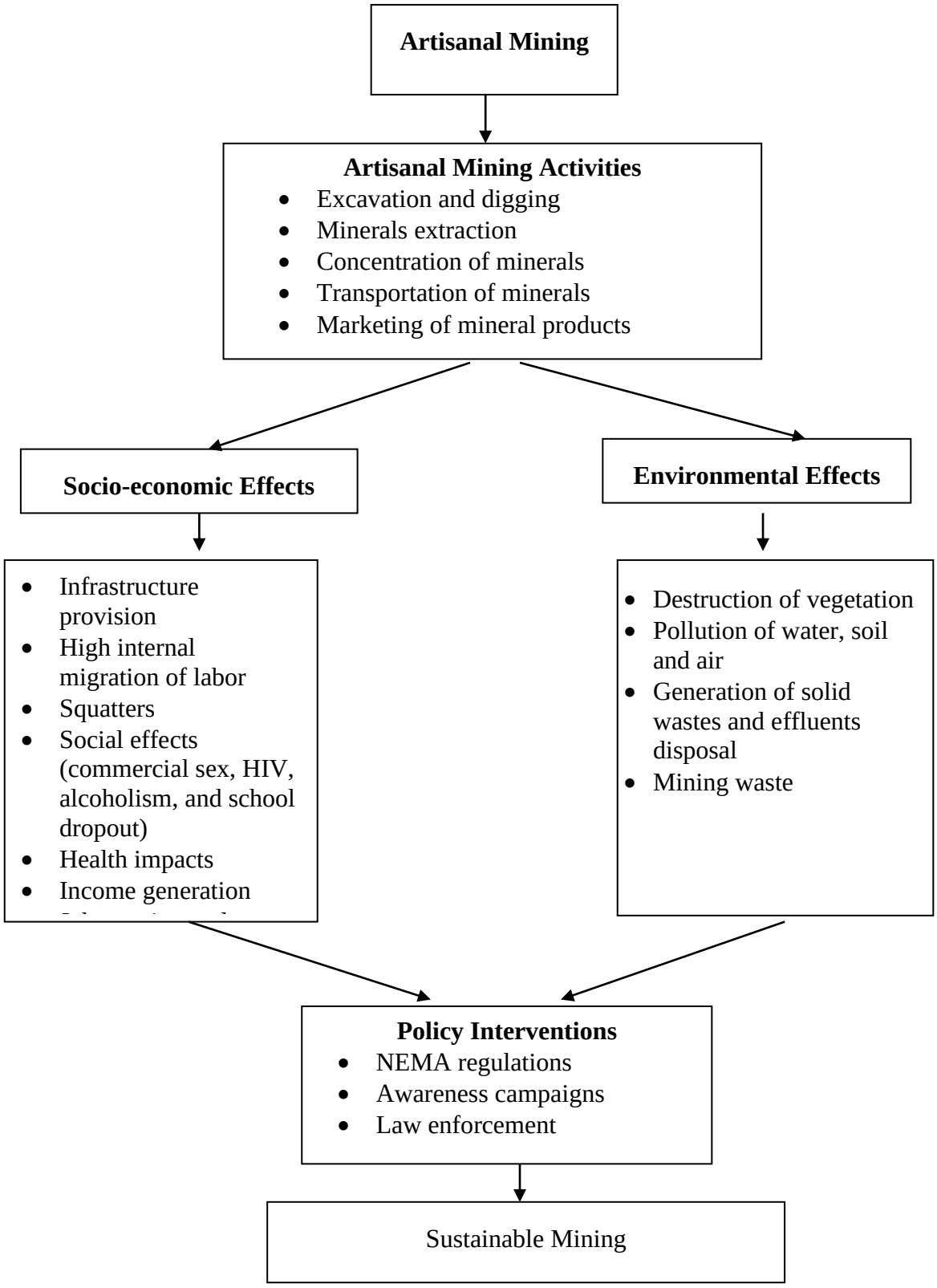

Figure 1: Conceptual Framework

Source: Modified from Asare 1999

2.8 Research Gap

Studies have been done on the effects of ASM. For instance, Nguyen *et.al* (2018) carried a study on social, economic and environmental influence from ASGM in Quang Nam Province, Vietnam. Also, Obiri *et al.* (2016) assessed how ASM influences the livelihoods of communities in Ghana and Dibal, Emoubome, Lekmang and Mallo (2016) examined on the impact of artisanal mining in parts of Naraguta sheet 168, north-central Nigeria. However, different countries are characterized by varying economic, social and environmental characteristics and hence the findings from one country cannot be generalized to another. These studies focused on artisanal mining of other natural resources, including gold and granite.

Studies conducted in Kenya focused on specific regions and natural resources. For instance, Maarifa, Mwikamba and Hamida (2016) conducted a study on the socio-economic and environmental impact of mining on women in the mining zone of Kasigau, TaitaTaveta County while Odhiambo (2016) examined the impact of open-pit artisanal gold mining in Rongo Constituency. Therefore, none of these studies were conducted on artisanal mining of soapstone in Tabaka. The equipment, resources, and skills required in gold mining are different from those required in soapstone mining.

CHAPTER THREE

3.0 METHODOLOGY

3.0 Introduction

This section presents the research methodology used in the research. It presents the study area, the research design, target population, the sampling procedures and data collection tools.

3.1 Study Area

3.1.1 Location

Tabaka ward is located in Kisii County about 24 Kilometers to the West of Kisii town. It borders Masaba South Sub-county in the northern part, Rongo Sub-county tyo the West, Trans Mara West Sub-county to the South and Gucha South Sub-county to the East. The total land size of the area is 200.2 Km2 and is found between latitudes 0°30’ and 0° 58’ South and to the east is found at longitudes 34°42’ and 35°05’ (Kisii District Development Plan 2008-2012).

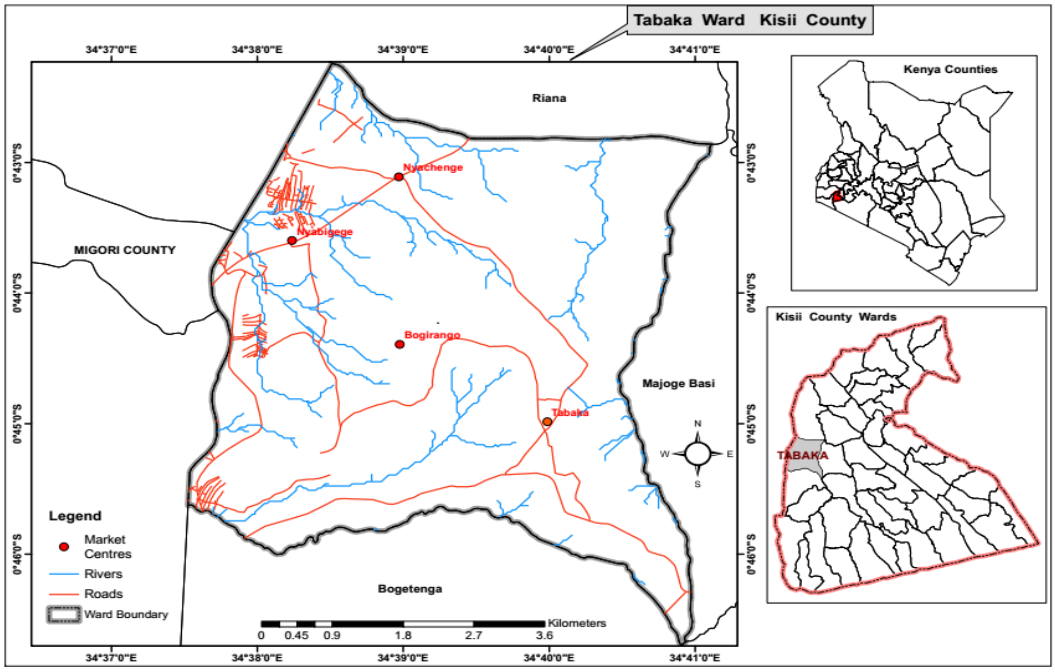

Figure 2.1: Map of Kisii County showing Tabaka

Tabaka ward comprises Bosinange, Bomonyara and Tabaka sub–Locations of Kisii County. It consists of hills and escarpments. To the South West region is Vinyo escarpment and Manga escarpment in the North West. These escarpments are major source of streams and rivers like river Gucha which flows in to Lake Victoria. (Kisii county government, 2017).

3.1.2 Geology and soils

The Bukoban, Nyanzanian and Kavirondian series of rocks forms the geological base of Tabaka region. These Precambrian rock dates back approximately two million years back. The Bukoban rock system dominates the area which is also referred to as the Kisii series of rocks. The primary nature of rock mainly consists of granite, banded ironstones, lava quartzite, sandstones, grits and secluded pockets of talc soapstone.

Most of the area is covered with fertile volcanic soils, with the exception of some areas with stony rocky outcrops. Brown fertile soil has recently been degraded by erosion that has made it loose productivity.

Soap stone rock is formed by metamorphosis of periodites which are subjected to pressure and heat at the points of convergence of plates.

3.1.3 Climatic Characteristics

Tabaka exhibits a bimodal pattern of rainfall with an annual rainfall of approximately 1,500mm this is a result of the highland equatorial climate experienced in the area. The long rains are experienced in March through to June, between September and November, the area experiences short rain; January and July are comparatively dry.

Generally, this is a warm region, with temperature highs of 30°C and lows of 15°C. April being the warmest temperatures averaging 27°C and August the lowest at of 18°C.

3.1.4 Infrastructure

The road leading to Tabaka from the main Kisii Migori highway is well tarmacked and this was done to ease movement of goods and services. Since it’s an area that attracts both local and international tourists who visit the place to buy soapstone artifacts for trophy and souvenirs. Though the road network is good, other essential amenities such as piped water and sewerage system are still lacking. The area has a hospital Tabaka mission hospital which takes care of the

area residence and also the surrounding. There are a number of schools in the area and about 32 bear the name Tabaka in their name a good example is the Tabaka primary which was built by the mining community.

3.1.5 Demographic characteristics of Tabaka.

The population of Tabaka was 34,214 in the year 2012, this comprised of 16,459 males and 17,755 females the population increased to 36,430 in the years 2015 and rose to 37,994 in the years 2017. Tabaka town is also found in Tabaka ward. The town's population was 12,700. 6,100 are men while 6600 are female in the years 2012. This population increased further to 15,825 in the year 2015, and then 16,471 in 2017 (Kisii county government, 2017).

3.1.6 Human settlements

The area has two types of settlements which include clustered settlement and scattered settlement. In the urban parts of the area, the clustered settlement is dominating, while scattered settlement dominates the rural parts. The main roads in the area have experienced development, which has led to cropping of new shopping centers, which has led waste management problems where the centers are unplanned (Kisii county government, 2017).

3.1.7 Economic Activity and Mining in Tabaka

Over 10,000 people have secured employment in Tabaka soapstone mining (Kisii County Government, 2018). Nevertheless, the mineral is not fully utilized as apart from curving other products including chalk, ceramic tiles, tale powder and paint can be made. Mining tools including hoes, shovels, machetes, axes and iron rods (which are used to chop the mineral into small parts) are used in mining soapstone. Most of the miners in Tabaka area are not mining professionals, but they are subsistence farmers who are carving during the evening or in the dry season. Since 1885 the activity of soapstone mining as well as carving has been taking place in Tabaka area. The bedrock of soapstone covers an area of approximately 25 square kilometers. The Department of Mining and Geology has estimated the rock to have a depth of 800 feet. Experts say that only 20% of this was exploited to date.

3.2 Research Design

This is a framework used to collect and examine measures of the study variables (Kothari, 2012). The design applied depends on the type of data needed, whether primary or secondary and thus could be experimental, case study or survey (Bhattacherjee, 2012). Given the data needs of the research, descriptive research design applied. Kothari (2012) noted that this design is concerned with events occurring in a study area that is either in the past or are continuing and which the researcher cannot manipulate.

3.3 Target Population

Creswell (2014) described it as a subset of the population with a specific characteristic that adequately addresses the research questions. For this present survey, the population comprised of individuals working as artisanal miners Tabaka soapstone mining in Kisii County. According to Buyeke and Njoroge (2015) and Obwori et al (2012), 1200 individuals are working in Tabaka soapstone mining. This population of interest for the study was therefore 1200 individuals who worked in and around Tabaka soapstone mines, the area chief, public health officer in Kisii County, an officer from the Ministry of Mining in Kisii County, the head of Energy, Water, Environment and Natural Resources department in Kisii County government, the head of Trade and Industry department, the head of Health Services department and the head of National Environment Management Authority (NEMA) in Kisii County.

3.4 Sample and Sampling Technique

A sample comprises of a particular group within a population of interest selected to represent and estimate the characteristics of an entire population (Russell, 2013). This must be adequate to represent the universe population. In this research, Slovin's Formula, which is a random sampling method, was suitable to use in determining the sample size since there was little known about the population. The Slovin's Formula is as follows;

$$n = \frac{N}{1 + NE^2}$$

Where:

n = Sample size

N = Population size

E = margin of error / error margin (0.05)

$$n = \frac{1200}{1 + (1200 * 0.05^2)}$$

$$n = 300$$

This study adopted simple random sampling to select 300 individuals working in Tabaka mines. This method ensured an equal probability in the selection of the sample members. The researcher visited the Tabaka mine and randomly selected the respondents (individuals working in the mines). The advantages of a simple random sample are that it is easy to use and ensures the entire population is accurately represented.

3.5 Data Collection Instruments

Primary and secondary data was collected during the survey. Secondary data was obtained from county reports, including the Kisii County Integrated Development Plan, and included material on the social and economic effects of artisanal mining. For primary data, administration of semi-structured questionnaires and interviews with key informants conducted. These instruments covered information on the social, economic and environmental effects of artisanal mining. Structured questions are preferred since they save time as well as financial resources. The research also used open-ended questionnaires since they give room for the respondents to express their opinions. Questionnaires are appropriate instruments to gather information from large samples and are beneficial as they ensure anonymity, reduce representative bias and save time and money since they can be collected simultaneously (Singpurwalla, 2013).

The interview guide helped the researcher to gather information from the key informants. Such interviews are conducted on people who are aware of the happenings of the community and are in-depth and qualitative. In this study, key informants included the area chief, public health officer in Kisii County, an officer from the ministry of mining in Kisii County, the head of Energy, Water, Environment and Natural Resources department in Kisii County government, the head of trade and industry department, the head of Health Services department and the head of National Environment Management Authority (NEMA) in Kisii County.

3.6 Reliability and Validity of the Research Instrument

The data collection instruments were pre-tested in the determination of the validity, reliability, accuracy and clarity. Validity denotes how well a research instrument measures what it is intended to measure (Sahu, 2013). The instruments were validated by pre-testing and making changes in any unclear, ambiguous, or incorrect questions. In addition, the researcher got opinions of experts in the field of environmental planning and management including the supervisor. The corrections in the questionnaires were made as advised by the supervisors.

Reliability describes the degree to which the measuring instruments can offer credible and dependable results. This is ably acquired by doing a pilot study to see if the results would be consistent and would thus be repeatable. Therefore, a pilot study was carried out to verify instrument reliability. Internal consistency was a factor in determining reliability. The internal consistency coefficient gives the reliability of measurement through the assumption of the correlation between the items measuring the same constructs (Walliman, 2011). Cronbach's alpha was used to determine internal coherence. The reliability of this method is increased with the value of the Cronbach alpha where the alpha values used range from 0 to 1. Where the coefficient is between 0.6 and 0.7, it is an acceptable reliability, whereas if the value is equal to or greater than 0.8, that reliability is considered good (Bryman and Cramer 2012). In this research, a 0.7-alpha Cronbach was found to be acceptable.

3.7 Data Collection Procedures

Prior to data collection, the researcher was provided with a letter of approval by the University of Nairobi. The National Commission issued a research license for Science Technology and Innovation (NACOSTI) to undertake the study. After requesting their consent, questionnaires were distributed and interviews with public officials scheduled. Respondents were requested to give their contact telephone numbers, which was to help in following up the respondents. After four days, the researcher picked up the questionnaire for processing. In the collection of the qualitative data using key informant interviews, the researcher booked appointments with each of the key informants to arrange on where and when to meet for the face to face interview.

3.8 Data Analysis

According to Russell (2013) this refers to the process of editing, coding, entering and thoroughly cleaning data to retrieve important information to be used for making conclusions as well as supporting decision making.

Descriptive statistics was used to analyze the data in the form of frequency, percentages, averages and standard deviations. This offered a descriptive understanding of the study variables, which include artisanal mining, social effects, economic effects and environmental effects. The study used inferential statistics to help test the hypotheses. The Spearman Rank-Order correlation employed to verify the degree of association between variables. Spearman rank-order correlation coefficient was used in this study as it analyses categorical variables. Regression analysis models were applied to determine to the extent to how the independent variable predicted the dependent variable at a confidence level of 95 per cent which suggests a significance level of 0.05. This means that for an independent variable to have a significant effect on the dependent variable, the p-value should be less than the level of significance (0.05). Social Science Statistics Toolkit (SPSS) was used to calculate the data and use the tools. Regression model for each of the hypotheses was as follows.

Regression model for hypotheses one;

H_{01}: Artisanal mining has no statistically significant socio-economic effects

$$Y = \beta_0 + \beta_1 X_1 + \varepsilon$$

Whereby; Y = Socio-economic effects; B_0 =Constant; β_1 =Coefficients of determination; X_1 = Artisanal mining; and ε = Error term

Regression model for hypotheses two;

H_{02}: Artisanal mining has no statistically significant environmental effects of artisanal mining

$$Y = \beta_0 + \beta_3 X_3 + \varepsilon$$

Whereby; Y = Environmental effects; B_0 =Constant; β_1 =Coefficients of determination; X_3 = Artisanal mining; and ε = Error term

3.9 Ethical Considerations

3.9.1 Voluntary Participation

Administration of questionnaires was done after permission from the miners. The researcher assured the respondents that information provided would be for educational purpose only.

3.9.2 Informed Consent

The researcher made sure that the respondents were fully aware of the purpose of the study. As Bryman and Cramer (2012) point out, the words of the researcher or even the researcher's status can impress some of the respondents, hence making them partakers of the research without even have clear information on the purpose of the research.

3.9.3 Confidentiality

The respondents were guaranteed utmost confidentiality of their response and authorized personnel were the only ones allowed to access the information. Furthermore, the findings were only used for this academic project.

3.9.4 Anonymity

Due respect was accorded to the respondent and no name was to be on the questionnaires. The researcher did not discriminate while picking the respondents. The researcher achieved this by ensuring self-administered questionnaires whereby the method of return was anonymous and no one was required to write his/ her name on the questionnaires.

CHAPTER FOUR

4.0 RESULTS AND ANALYSIS

4.1 Introduction

The section centers on the examination, presentation and interpretation of data. Descriptive and inferential statistics was used to come up with results, which were further analyzed by correlation analysis and regression analysis.

4.2 Response Rate

The study got information from a sample size of 300 which comprised of individuals working in Tabaka soapstone mining, the area chief, public health officer in Kisii County, an officer from the ministry of mining in Kisii County, the head of Energy, Water, Environment and Natural Resources department in Kisii County government, the head of trade and industry department, the head of Health Services department and the head of National Environment Management Authority (NEMA) in Kisii County. Questionnaires were distributed to 300 respondents during the collection of data, with 289 respondents successfully completing and returning their questionnaires. This resulted in a response rate of 96.3 per cent. Kothari (2012) found that an excellent response rate is still greater than 70% but that a response rate greater than 50% is considered adequate to analyze the data and report on findings. From the response, this study is within acceptable bounds to draw conclusions and make recommendations. This displayed in Table 4.1.

Table 4.1: Response Rate

	Sample Size	Response	Percent
Soapstone Miners	293	282	94
The area chief	1	1	0.0033
Public health officer	1	1	0.0033
An officer from the ministry of mining	1	1	0.0033
Head of Energy and Water	1	1	0.0033
Head of trade	1	1	0.0033
Head of Health Services	1	1	0.0033
Head of NEMA	1	1	0.0033
Total	**300**	**289**	**96.3**

Source: Research Data (2020)

4.3 Demographic characteristics

General data of participants comprised of their gender, age, educational attainment, marital status, origin and occupation.

4.3.1 Age bracket of the Respondents

As part of the overall information, participants indicated their age ranges. This is indicated in Table 4.2. From the outcomes, 20.4% indicated they were between 21 years and 25 years, 18.3% indicated that they were between 31 years and 35 years, further, 13.8% specified that they were 26 years and 30 years. 13.5% were between 41 years and 45 years, 12.1% were between 36 years and 40 years, 10.38% were between 16 years and 20 years, 6.2% were between 46 years and 50 years, 2.4% were between 51 years and 55 years, 1.4% were between 56 years and 60 years while the same percent (1.4%) of the respondents indicate they were between 61 years and 65 years. This means that most respondents ranged in age from 21 to 25.

Table 4.2: Age of the respondents

Age Bracket	Frequency	Percent
16-20	30	10.38
21-25	59	20.40
26-30	40	13.8
31-35	53	18.3
36-40	35	12.1
41-45	39	13.5
46-50	18	6.2
51-55	7	2.4
56-60	4	1.4
61-65	4	1.4
Total	**289**	**100**

Source: Research Data (2020)

4.3.2 Gender of the Respondents

The participants were requested to indicate their gender. These findings are presented in Figure 4.1. 62.6% were male and 37.4% were female. This meant that most respondents were males.

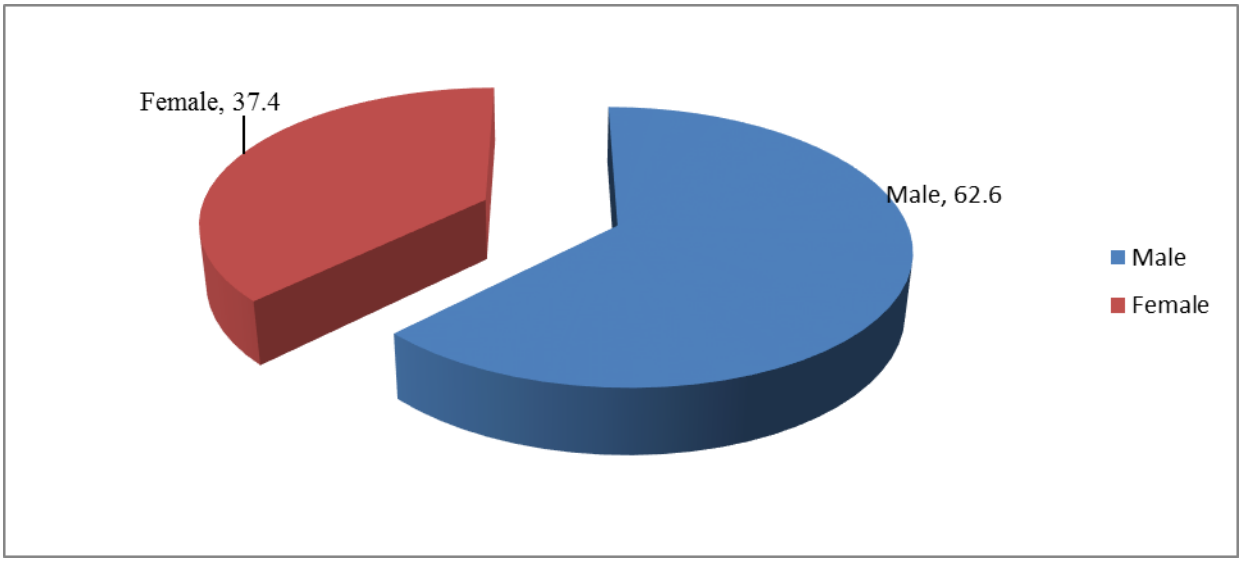

Figure 3.1: Gender of the Respondents

Source: Research Data (2020)

4.3.3 Level of Education

Participants had to identify their level of educational attainment. This is illustrated by Figure 4.2. Results show that 48.1% of participants had a high school education, 23.5% had a diploma, 17.3% had a university education, 7.6% had a primary education and 3.5% did not have a formal schooling.

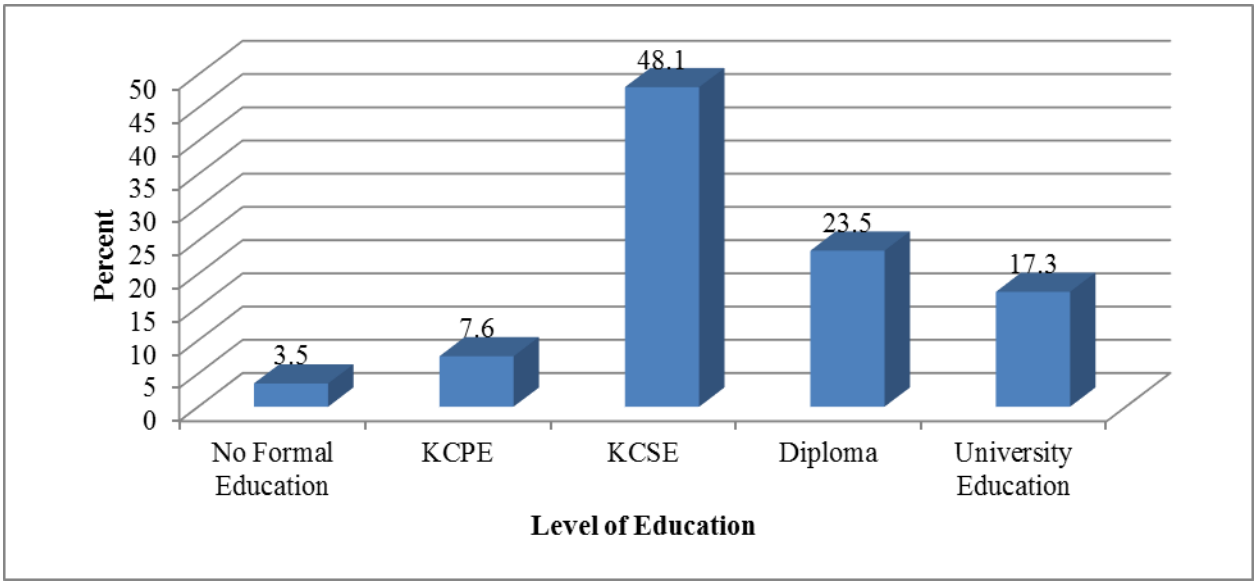

Figure 4.2: Level of Education

Source: Research Data (2020)

4.3.4 Marital Status

The marital status is shown in figure 4.3. From the results, 50.5% of the participants were married, 45.3% were single, 2.1% had separated while the same percent (2.1%) was divorced. As per the result, most respondents were married.

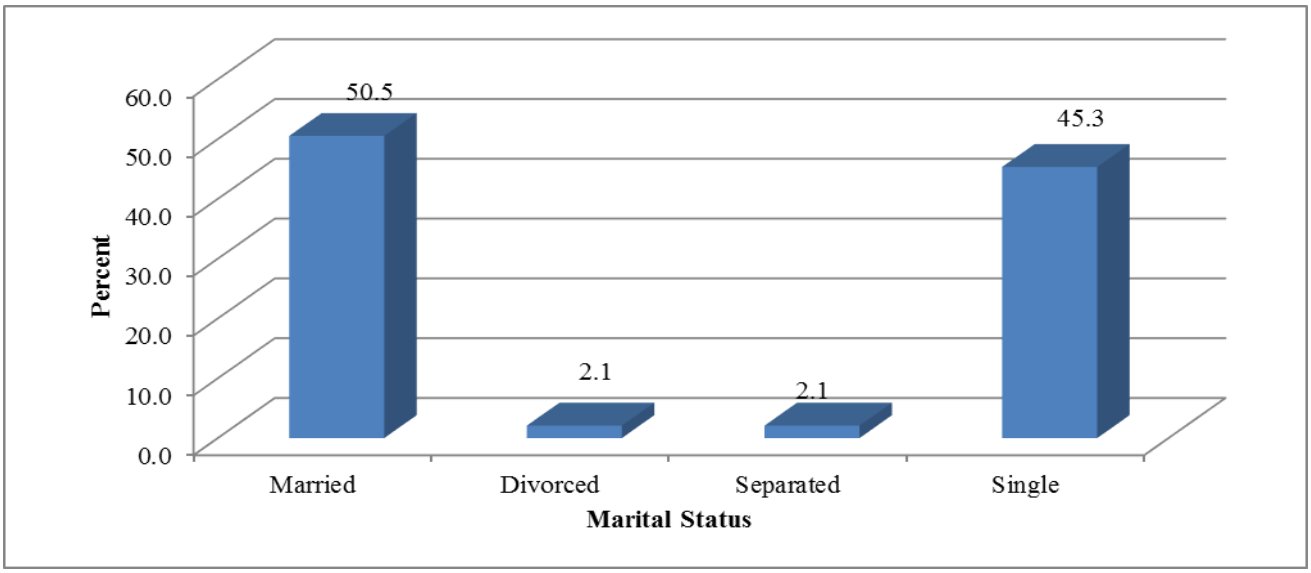

Figure 5.3: Marital Status

Source: Research Data (2020)

4.3.5 Place of Origin

The participants were requested to indicate whether they were migrants or natives. These findings are presented in Figure 4.4. The results indicate 91.3% were natives while 8.7% were migrants. This implies that most of the participants were natives of Tabaka area.

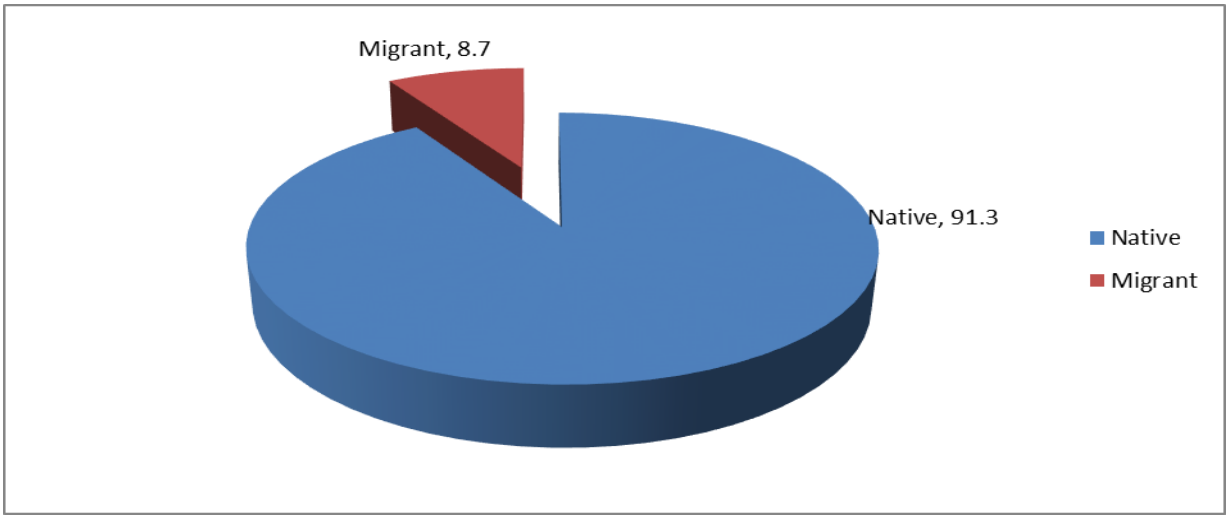

Figure 6.4: Place of Origin

Source: Research Data (2020)

4.3.6 Area of Specialization of the Participants

The respondents specified their area of expertise. The results were as shown in Table 4.2. From the results, 27% (78) of the participants were specialized in Using Soapstone in Sculpturing, still, the same percent, 27% (78) in Marketing Soapstone Products, 18.7% (54) in digging/ excavation, 5.5% (16) in carrying soapstone while 2.4% (7) were security personnel. This implies that most of the miners in Tabaka mine are specialized in digging.

Table 4.3: Specialization of the Participants

Specialization	Frequency	Percent
Digging/ Excavation	54	18.7
Sculpturing	78	27
Marketing Soapstone Products	78	27
Carrying Soapstone	16	5.5
Security	7	2.4
Total	**233**	**80.6**

Source: Research Data (2020)

4.4 Nature and Extent of Artisanal Mining

The first specific goal of this survey was to examine the nature and extent of artisanal mining in Tabaka, Kisii. The researcher visited the area and observed and got photographs of the place as it was in the mines.

4.4.1 Soapstone Mining

To get a clear picture on the nature of mining in the area, in depth interviews were carried out with county officials. It was noted that the miners in Tabaka do not have mining licences and therefore the county government identifies it as an illegal activity. Also said that regulating them is difficult since this mines were on individual land and hence the mines are private properties.

> *We take the mining activities as illega because the miners do not have licences. The county governmant has released a stop order till when there will be ellaborate plan on how best mining can be done sustainably. (KI 001).*

The participants were requested to indicate how soapstone activities take place.The participants indicated that the first step is to clear the top vegetation in the area where the soapstone is

suspected to be, this is then followed by clearing the topsoil and removing the rest of the soil using tools and equipment like hoes and spades. The soapstone is then excavated using tools like chisel, hammer and machetes.

Once the soapstone is excavated by the miners, it is transported to working areas where the artisans curve it into different sculptures. The transportation is mainly manual where the rocks are carried on shoulders, on the head and sometimes side by side by the miners. The artisans sculpture them into different i.e. animals, people sculptures after which the sculptures are built using a subtractive method which utilizes several tools like machetes, chisels and knives. The carvings are then graced by being colored and polished then considered ready for sale.

Plate 4.1: Soapstone Mining in Tabaka

Source: Research Data (2020)

4.4.2 Requirements for mining in Tabaka

The participants were requested to indicate the requirements for one to start mining in Tabaka. From the findings, the respondents showed that for one to begin mining in Tabaka, he/she should have access to land that has soapstone, own a quarry (individual ownership) and required tools/equipment. These tools include saws, machetes, jembe, an axe among others. Farther, the respondents revealed that one should likewise possess the basic skills and knowledge required for soapstone mining, merchandising and pricing.

4.4.3 The amount of Soapstone Mined in Tabaka Weekly

Respondents were asked how much soap stone was extracted from the Tabaka mines each week as depicted in Table 4.3. From this,36.7% revealed that less than 10 tonnes of soapstone is mined in Tabaka mines per week,15.6% indicated more than 50 tonnes,14.5% indicated between 41 tonnes and 50 tonnes,13.1% indicated between 11 tonnes and 20 tonnes,11.8% indicated between 21 tonnes and 30 tonnes while 8.3% of the respondents indicated that between 31 tonnes and 40 tonnes of soapstone is mined in Tabaka mines per week

> *The amount of soapstone mined in Tabaka mines varies with season, demand from the customers and available workforce. When the demand is high we can even mine up to 10 tonnes per week* (KI 002).

4.4.4 Artisanal Mining Activities Related to Soapstone

Respondents were requested to indicate to what extent they agree with various statements regarding artisanal mining activities and their effects on socio-economic and environmental activities. A 5-point Likert scale was used whereby 1 signified very low, 2 signified low, 3 signified moderate, 4 signified high and 5 signified very high. The results were presented in Table 4.4

Table 4.4: Artisanal Mining Activities affecting Socio-economic and Environmental Activities

	1	2	3	4	5	Mean	Std. Deviation
Excavation and digging	1.4	2.1	6.9	66.4	23.2	4.080	0.710
Minerals extraction and processing	0.0	1.4	7.6	68.9	22.1	4.118	0.583
Concentration of minerals	0.0	2.8	22.1	47.4	27.7	4.000	0.782
Transportation of minerals	0.7	2.1	25.3	40.1	31.8	4.004	0.848
Marketing of mineral products	0.0	0.7	10.4	61.2	27.7	4.159	0.620

Source: Research Data (2020)

The respondents indicated that the marketing of mineral products has a high influence on the socio- economic and environmental characteristics of Tabaka. That is indicated by an average of 4.159(std. dv = 0.620). Further, as revealed by a mean of 4.118 (std. dv = 0.583) respondents indicated that mineral extraction and processing has a high influence on socio-economic and environmental characteristics of Tabaka. Excavation, tunneling and digging have a high influence on socio- economic and environmental characteristics of Tabaka (the socio-economic effects include infrastructure provision, high internal migration of labour and squatters). Showed by a mean of 4.080 (std. dv = 0.710). Participants revealed that transportation of minerals has a high influence on socio-economic and environmental characteristics (the environmental effects include the destruction of vegetation, pollution of water soil and air and generation of solid waste disposal) of Tabaka. Indicated by a mean of 4.004 (std. dv = 0.848). Hruschka and Echavarria, (2011) on their study socioeconomic and environmental effects of artisanal mining in Morrocco observed a positive impact socially by noting that mining contributed to national and local income; an increase in export and GDP that led to poverty reduction. Also, it created business and job opportunities in some industries as a result of economic and market growth.

On average 4.000(std. Dv = 0.782), participants revealed that mineral concentrations have a strong influence on Tabaka's socioeconomic and environmental characteristics. According to Huesca (2013) artisanal mining comes with social changes that affect the community.

4.5 Socio-economic Effects of Artisanal Mining

The second specific objective of the study was to assess the socio-economic effects of artisanal mining.

4.5.1 Occupation of the Participants

Participants were asked about their occupations. These findings are presented in Figure 4.5. 57.4% of the participants revealed that are in informal employment, 17.6% indicated that they were full-time students, 12.8% pointed out that they were part-time students while 12.1% of the participants revealed that they were employed. This implies that majority of the people in Tabaka practice artisanal mining as an occupation. The largest practicing informal employment. Socio-economic growth in the region may be minimal unless alternative mass technological mining methods are applied.

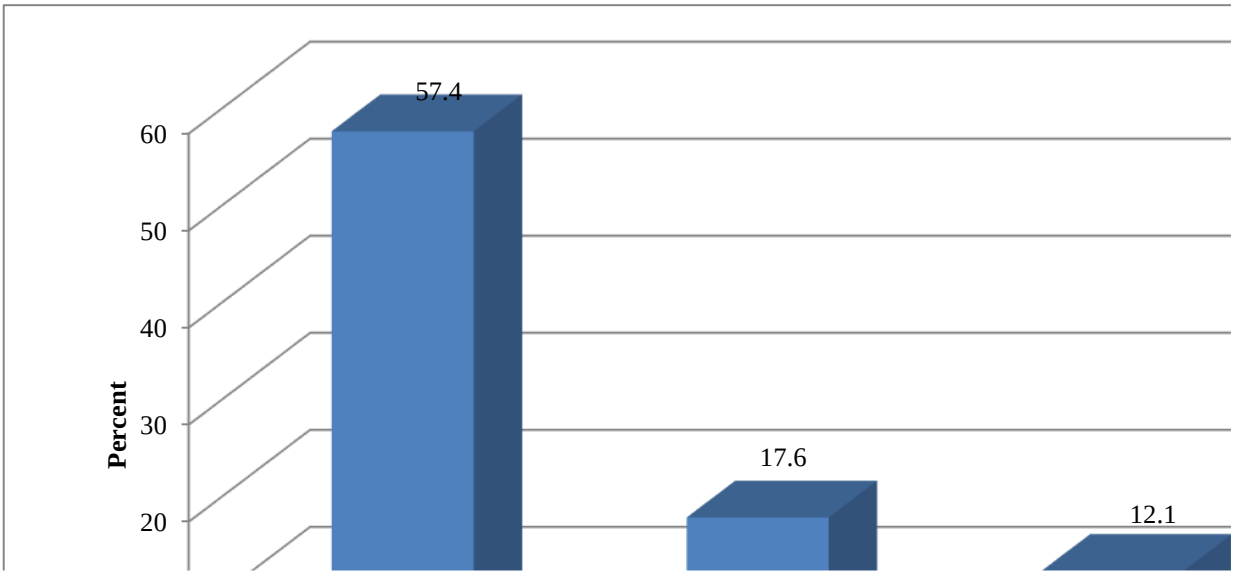

Figure 7.5: Occupation of the Participants

Source: Research Data (2020)

4.5.2 Working duration in the Mines

Participants were also asked what period they had been involved with the mines. The results are in Figure 4.6. From the results, 28% had worked in the mines for less than 5 years, 26.9% indicated 6 years and 10 years, 15.9% indicated a period between 16 years and 20 years, 8.3% pointed to have been working for 11 to 15 years, 6.2 indicated 26 years and 30 years, 4.5%

indicated 21 years and 25 years while 1.04% indicated 31 years and 35 years. About 55% of the respondents have been fully active working in the mines for less than 10 years. Mining being such a physical demanding job may influence the participation of the miners in other social activities such as advancement in education and also puts pressure on the environment. This is shown by the results In Figure 4.5 where only 17% of the respondents are full time students.

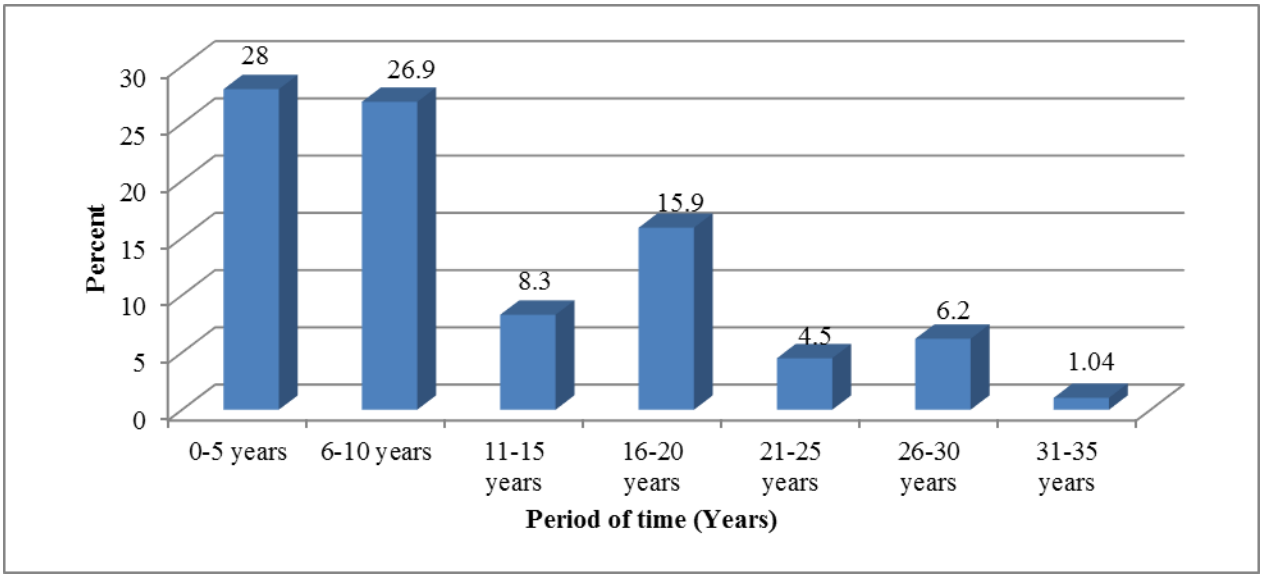

Figure 8.6: Working Duration in the Mines

Source: Research Data (2020)

4.5.3 Household Size

Respondents were asked about the size of their households. This is shown in Table 4.5. From the results, 51.9% indicated that their family members range between 3 members and 5 members, 31.8% indicated between 6 members and 8 members, 10% indicated less than 2 members, 2.8% indicated between 9 members and 11 members, 2.1% indicated 12 members and 14 members while 1.4% of the respondents indicated more than 15 members. About 80% of the respondents have a household size ranging from 3-8 members. This large number may be a strain to families where their income may not be adequate for the entire family needs.

Table 4.5: Household Size

Size of Household	Frequency	Per cent
Less than 2	29	10
3-5	150	51.9
6-8	92	31.8
9-11	8	2.8
12-14	6	2.1
Above 15	4	1.4
Total	**289**	**100**

Source: Research Data (2020)

4.5.4 Household Income Per Day Before Mining

Participants were asked to indicate their family income per day before joining artisan mining. These findings have been described in Table 4.6. From the findings,29.4% revealed their income per day was less than Ksh 100,27.7% indicated between Ksh101 and Ksh200,16.6% indicated between Ksh 901 and Ksh 1000,12.5% indicated between Ksh 301 and Ksh400,4.8% indicated between Ksh401 and Ksh 500,2.8% indicated more than Ksh 1000 while 1.4% were earning between Ksh 701 and Ksh800, also the same percent 1.4% were earning between Ksh 801 and Ksh 900. About 70% of the respondents earned less than Ksh 400 per day prior to being active miners. The earned incomed may influence the soci-ecomomic of the region in their participation to fully fund their education while providing for the families.

Table 4.6: Household Income per Day before Mining

Income Per day (Ksh)	Frequency	Per cent
Below 100	85	29.4
101-200	80	27.7
301-400	36	12.5
401-500	14	4.8
501-600	6	2.1
601-700	0	0
701-800	4	1.4
801-900	4	1.4
901-100	48	16.6
Above 1000	8	2.8
TOTAL	**289**	**100**

Source: Research Data (2020)

4.5.5 Household Income per Day after the Advent of Mining

The participants were then requested to indicate their daily income after joining mining. Table 4.7 shows the results. 38.1% revealed that their income per day was between Ksh 201 and Ksh 400,20.8% indicated between Ksh401 and Ksh600,11.4% indicated less than Ksh 200,8.2% were earning more than Ksh1400 per day,6.9% indicated between Ksh 801 and Ksh1000,5.2% indicated between Ksh1001 and Ksh 1200,4.8% indicated between Ksh 601 and Ksh 800 while 4.5% were earning between Ksh 1201 and Ksh1400. About 70% of the respondents earned less than Ksh 600 per day after fully becoming active miners which is about 50% increment in their earned wages. Though the earned income is a significant increase, it may still influence the soci-ecomomic of the region in their participation to fully fund their education while providing for the families.

Table 4.7: Household Income Per Day After the Advent of Mining

Income Per Day (Ksh)	Frequency	Percent
Below 200	33	11.4
201-400	110	38.1
401-600	60	20.8
601-800	14	4.8
801-1000	20	6.9
1001-1200	15	5.2
1201-1400	13	4.5
Above 1400	24	8.3
TOTAL	**289**	**100**

Source: Research Data (2020)

4.5.5 The Importance of the Income Per Day

The participants were requested to suggest how the income from mining activities helped them. From the results, the participants indicated that they used income from mining to cater for their basic needs (food, lodging and clothing). In addition, participants indicated that they were using income from the mining activities to cater for their children's education.

> *Through the income, I get from the mining activities I can cater for the school fees of My two daughters and also do their shopping. Further am also able to afford their clothing* (KI 002).

This was also noted by the area Chief who acknowledged that the income got from the soapstone related activities is somehow put to good use as the residence there use it to pay school fees and other basic needs and even venture into other businesses.

> *From the soapstone earnings, the locals are able to see their children through school and at the same time supply their basic needs like food, shelter and clothing therefore improving their standards of living.* (KI 003)

According to Buss *et al* (2017), economic stability gotten from mining activities has made women diversify into other economic activities. Some have managed to save and raise capital for other sources of income even though their earning is way less than the men in mining.

4.5.6 Transport

Further, the respondents were to indicate the estimate of transportation cost per day to the mines. The results are shown in Table 4.9. About 23.5% revealed their transport cost to be less than ksh 50 per day, 17.9% indicated between Ksh50 and Ksh100,9.7% indicated between Ksh 100 and Ksh 150, also 9.7% indicated between Ksh 150 and Ksh200,7.6% indicated between Ksh250 and Ksh 300,7.2% indicated between Ksh300 and Ksh 350,6.9% indicated between Ksh 350 and Ksh400,5.2% indicated between Ksh400 and Ksh450 while 3.5% were spending between Ksh 450 and Ksh 500 for the fare. Also, the same percent were spending more than Ksh500 for fare. About 60% of the respondents are spending less that Ksh 200 per day on transportation cost. This is a significant amount about 33% of their daily earned income. The cost of transportaion reduces the daily earned income which result to reduced development of individual and socio economic growth in Tabaka.

Table 4.8: Transportation per Day

Transport Cost (Ksh)	Frequency	Percent
Below 50	68	23.5
50-100	52	17.9
100-150	28	9.7
150-200	28	9.7
200-250	14	4.8
250-300	22	7.6
300-350	21	7.2
350-400	20	6.9
400-450	15	5.2
450-500	11	3.5
Above 500	10	3.5
TOTAL	**289**	**100**

Source: Research Data (2020)

4.5.7 Economic Effects of Artisanal mining

The participants were requested to rate various statements relating to the economic effects of artisanal and small scale mining in Tabaka. This is presented in Table 4.9.

Table 4.9: Economic Effects of Artisanal mining

	1	2	3	4	5	Mean	Std. Deviation
Provision of market for farm produce	6.9	58.5	24.9	4.2	5.5	2.429	0.895
Abandonment of farms	2.1	1.4	4.2	39.8	52.6	4.395	0.810
Reduced farming land	2.8	6.9	22.5	36.0	31.8	3.872	0.028
Increased monthly Income	4.8	6.2	22.5	30.4	36.0	3.865	0.121
Job creation	6.9	73.7	5.5	11.1	2.8	2.291	0.857
Expansion of industrial and Commercial activities	14.2	51.2	15.2	12.5	6.9	2.467	0.096
Reduction of poverty	0.7	13.5	34.6	23.5	27.7	3.640	0.048

Source: Research Data (2020)

With an average of4,395 (standard. dv = 0.810), participants revealed there is a high rate of abandonment of farms in Tabaka area as a result of artisanal mining. Moreover, as can be seen from the average of 3,872 (std. dv = 0.028), the participants revealed there is a high rate of reduced farming land as a result of artisanal mining. In addition, the participants indicated that there is a high rate of increased monthly income as a result of artisanal mining. That is indicated by an average of 3.865(std. dv = 0.121). On average 3.640(std. dv = 0.048) also indicated a high

rate of reduction of poverty. Obiri *et al* (2016) revealed that artisanal mining leads to economic improvements as well as poverty reduction.

However, averagely 2.467(std. dv = 0.096), the participants indicated that even though artisanal mining is rapidly growing, there is still a low rate of expansion of industrial and commercial activities. Further, at an average of 2.429 (std. dv = 0.895), the participants indicated there is a low rate of provision of the market for farm produce. A mean of 2.291 (std. dv = 0.857) indicated that there is a low rate of job creation. Shoko and Mwitwa (2016) revealed that artisanal mining has a substantial impact on socio-economic activities.

4.5.8 Social Effects of Artisanal Mining

The participants were requested to rate various statements relating to the social effects of artisanal mining. The results were as depicted in Table 4.10.

Table 4.10: Social Effects of Artisanal Mining

	1	2	3	4	5	Mean	Std. Deviation
Changed lifestyle of dressing	22.5	42.9	24.9	5.5	4.2	2.260	0.003
Conflict between indigenous and migrant	9.0	28.7	44.3	9.7	8.3	2.796	0.019
Drop in school enrolment	1.4	2.1	24.6	29.1	42.9	4.100	0.936
Schools absenteeism	1.4	2.8	25.3	45.7	24.9	3.900	0.854
Improved supply of electricity	1.4	2.8	8.7	42.9	44.3	4.260	0.837
Increased land prices in the area	2.1	2.1	10.1	47.1	38.8	4.183	0.852
Improved healthcare	2.8	28.0	37.4	19.4	12.5	3.107	0.037
Increased house rent prices	2.8	7.6	41.2	27.7	20.8	3.561	0.992
Increase in the crime rate	1.4	1.4	6.2	73.0	18.0	2.048	0.649
Improvement in the living standards	1.4	11.1	23.9	44.3	19.4	3.692	0.953
Influx of immigrants and visitors in search of jobs	0.7	3.5	45.3	42.2	8.3	3.540	0.726
Increase in alcoholism and prostitution	14.5	32.9	26.3	11.8	14.5	2.789	0.253

Source: Research Data (2020)

With an average of 4.260(std. dv = 0.837), the participants revealed there is a high rate of improved supply of electricity in Tabaka area as a result of artisanal mining. Further, shown by a mean of 4.183 (std. dv = 0.852), participants revealed that land prices are increasing with time as a result of the mining activity. In addition, the participants indicated that there is a decrease in school enrolment as revealed by a mean of 4.100 (STD. dv = 0.936). A mean of 3.900 (std. dv = 0.854) agreed that there is a high rate of school's absenteeism. Potter and Lupiya (2016) revealed that most of the ASM activities are done as a family with the boys joining their parents in hard labor while the girls join their mothers in providing support services and doing lighter jobs in the mines. Most form their careers in ASM activities which eventually contribute to a high rate of school drop-out.

From the results, the participants revealed a high improvement in living standards. This is shown by an average of 3.692(std. dv = 0.953). Further, participants revealed there being a high increase in house rental prices, pointed out with mean of 3.561 (std. dv = 0.992). 3.540(std. dv = 0.726) participants revealed a high influx of immigrants and visitors in search of jobs. Buss et al (2017) indicated that artisanal mining creates employment opportunities hence leading to people searching for casual jobs being attracted to migrate to mining regions to guarantee line of works. However, the participants indicated a moderate improvement in health care this indicated by mean of 3.107 (std. dv = 0.037). An average of 2.796 (std. dv = 0.019) showed participants also indicated a moderate rate of conflict between indigenous and migrant workers.

In addition, the participants indicated a moderate increase in alcoholism and prostitution. As indicated by a mean of 3.2.789 (std. dv = 0.253). A mean of 2.260 (std. dv = 0.003) indicated those who agree with a low rate of change in lifestyle of dressing. Furthermore, with the average of 2,048 (std. dv = 0.649) the participants indicated a low rate of change in lifestyle of dressing. Shoko and Mwitwa (2016) among the effects of artisanal mining include poor quality education and high illiteracy level, which is facilitated by long distances and inadequate learning resources, increased crime rate and prostitution, unsustainable education and literacy level. This is a result of inadequate schools, low-quality education, limited learning resources and increased rate of school dropouts.

4.5.9 Correlation Analysis for Socio-economic Effects of Artisanal Mining

This study applied the Spearman Rank-Order correlation analysis to identify the relationship between socio-economic effects and artisanal mining at Tabaka, Kisii County. As shown in Table 4.11 small-scale mining has a positive and significant effect on socio-economic activities (r=0.908, p=0.000). The association was significant since the p value (0.000) was less than the significance level of 0.05. Therefore, the null hypothesis stating that artisanal mining has no significant socio-economic effects in Tabaka, Kisii County was rejected. Findings were consistent with those of Ogembo (2015) that artisanal mining effects socio-economic activities positively and significantly. Mining activity provides money for local revenue and hence boosts the local economy by providing services and equipment to sustain the mining.

Table 4.11: Correlations Coefficients

			Social-economic Effects	**Artisanal Mining**
Spearman's rho	Social-economic Effects	Correlation Coefficient	1.000	.908**
		Sig. (2-tailed)	.	.000
		N	289	289
	Artisanal Mining	Correlation Coefficient	.908**	1.000
		Sig. (2-tailed)	.000	.
		N	289	289

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

Source: Research Data (2020)

4.5.11 Regression Analysis for Socio-economic Effects of Artisanal Mining

A multivariate regression analysis was used to determine the association between the socioeconomic effects of small-scale mining.

The model was as follows:

$$Y = \beta_0 + \beta_1 X_1 + \varepsilon$$

Where; Y = is the dependent variable (Socio-economic), β_0 = Constant Term; β_1 = Coefficients of determination; X_1= Artisanal mining, and ε = error term.

The R-squared was used to illustrate the variation in the dependent variable (Socio-economic effects in Tabaka) that could be explained by the independent variable (Artisanal mining). The R per square was 0.825 and this means that 82.5% of the dependent variable (socio-economic effects at Tabaka) could be explained by independent variables (artisanal extraction).

Table 4.12: Model Summary

Model	R	R Square	Adjusted R Square	Std.s Error of the Estimate
1	.908[a]	.825	.824	.31155

a. Predictors: (Constant), Artisanal Mining

Source: Research Data (2020)

The ANOVA was used to assess whether the model was a good fit for the data. As depicted in table 4.15, the F calculated 101.55 was higher than the F critical value 2.759. In addition, the p-value (0.000) was below the significant level (0.05) and therefore the model could be used to explain the influence of the independent variables (Artisanal extraction) on the dependent variable (Socioeconomic effects in Tabaka). This made the model suitable for the data.

Table 4.13: Analysis of Variance

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	98.5	1	131.128	101.55	.000[b]
	Residual	27.858	287	.097		
	Total	158.986	288			

a. Dependent Variable: Social-economic Effects
b. Predictors: (Constant), Artisanal Mining

Source: Research Data (2020)

The regression equation was;

$Y = -1.335 + 1.192X_1$

The answers revealed that Artisanal mining has a positive and significant Socio-economic effects in Tabaka ($\beta 1 = 1.192$, p value= 0.000). The association was significant as the significant level (0.05) was superior to the p-value (0.000). Therefore, based on the results, the null Hypothesis: Artisanal mining has no significant socio-economic effects in Tabaka, Kisii County should be rejected. This implies that artisanal mining leads to an improvement in socio-economic effects in

Tabaka. The findings are in agreement with Ogembo (2015) findings that artisanal mining has a positive and significant effect on socio-economic activities. Mining activity provides money for local revenue and hence boosts the local economy by providing services and equipment to sustain the mining.

Table 4.14: Regression Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-1.335	.133		-10.011	.000
	Artisanal Mining	1.192	.032	.908	36.755	.000

a. Dependent Variable: Social-economic Effects

Source: Research Data (2020)

4.6 Environmental Effects of Artisanal Mining

The third specific objective of the study was to assess the environmental effects of artisanal mining at Tabaka, Kisii.

4.6.1 Change in the Colour of Water Bodies

The participants responded to question on change in the colouration of water bodies around Tabaka area. The answers were as described in Figure 4.7. From the outcomes, 75.1% of the respondents revealed that colour of water bodies has remained unchanged, 15.2% indicated that the colour of water bodies has deteriorated while 9.7% of the respondents indicated that colour of water bodies has improved. This implies that colour of water bodies around Tabaka area has remained unchanged.

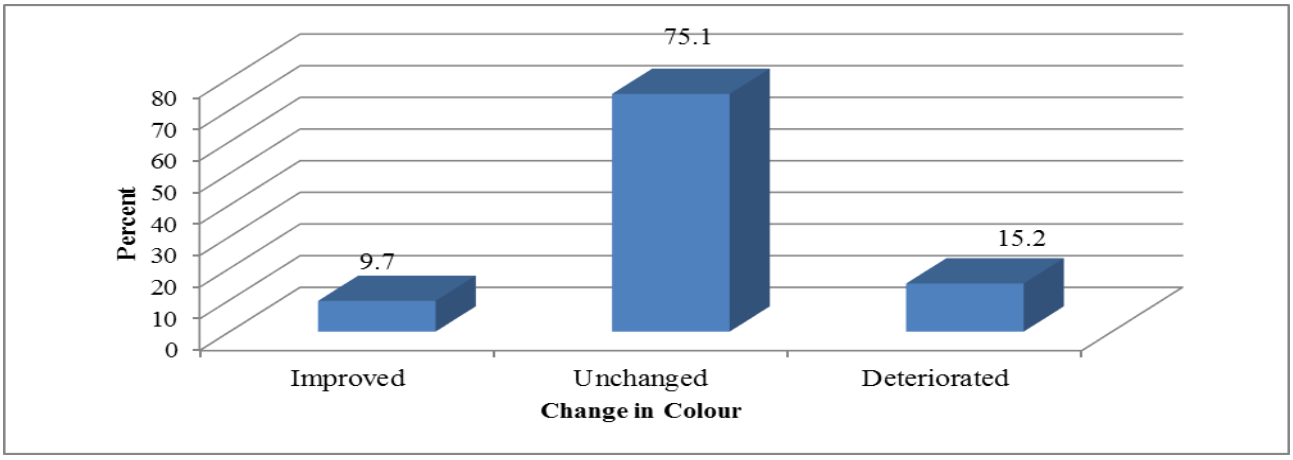

Figure 9.7: Change in the colour of Water Bodies

Source: Research Data (2020)

4.6.2 Change in Smell of the Water Bodies

The response on change in the smell of water bodies around Tabaka area was as follows; From the outcome, 75.1% of the respondents revealed that the smell of water bodies has remained unchanged, 15.2% indicated that the smell of water bodies has deteriorated while 9.7% of the respondents indicated that the smell of water bodies has improved. This implies that the smell of water bodies around Tabaka area has remained unchanged. Figures 4.8 show the results.

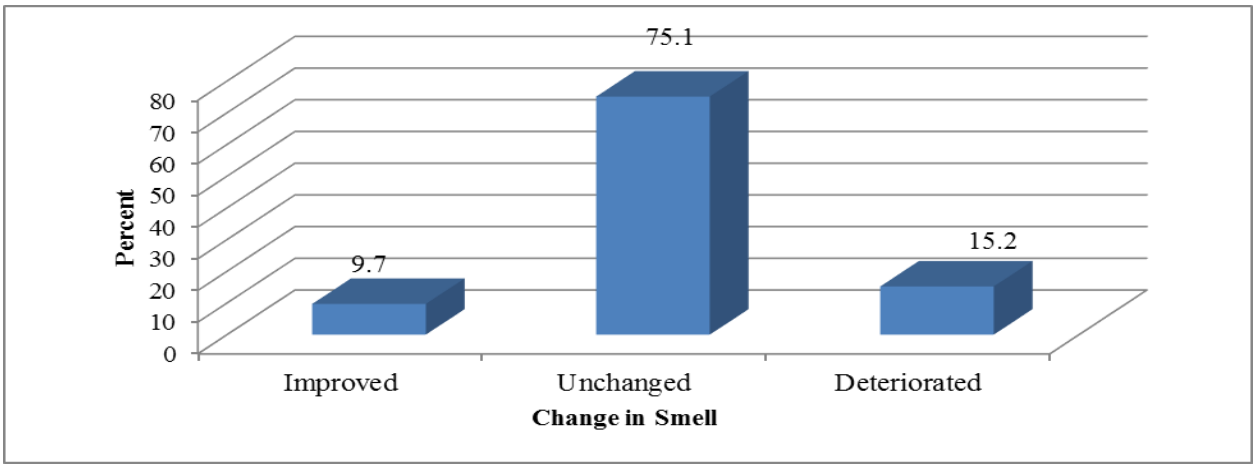

Figure 10.8: Change in Smell of Water Bodies

Source: Research Data (2020)

4.6.3 Environmental Effects of Artisanal Mining

Mining activities occur in the natural environment and usually influence it. The participants were asked to indicate on the level that the mining activity affects the environment. The information is shown in Table 4 15.

Table 4.155: Environmental Effects of Artisanal Mining

	1	2	3	4	5	Mean	Std. Deviation
Noise and Ground vibration	36.7	31.1	14.9	13.1	4.2	2.170	0.180
Increase release of dust from the mines	23.5	32.2	27.0	11.1	6.2	2.443	0.148
Air pollution	27.7	40.5	20.8	5.5	5.5	2.208	0.079
Environmental disaster/ deaths	30.4	48.4	16.3	1.4	3.5	1.990	0.915
Physiological disorder of crops	29.8	40.1	16.3	6.2	7.6	2.218	0.163
A threat to crops and farmlands	27.0	31.1	27.7	11.4	2.8	3.318	0.075
Land and vegetation degradation	2.8	4.2	7.3	63.7	22.1	3.983	0.845
Water pollution	47.1	42.6	4.2	4.8	1.4	1.709	0.865
Disease due to drinking water	49.5	39.4	5.5	2.8	2.8	1.699	0.907
Water pollution as a potential health risk	50.5	37.0	6.2	6.2	0.0	1.682	0.847
Rock waste and debris	2.8	4.2	32.2	29.1	31.8	3.830	0.015

Source: Research Data (2020)

As shown above, it is indicated that there is a high rate of land and vegetation degradation. This was indicated with an average of 3,983 (std. dv = 0.845). With an average of 3,830 (std. dv = 0.015) participants also indicated a high rate of rock waste and debris. According to Djibril *et al* (2017) mining effects both the mining area and adjacent neighbouring communities. Deforestation makes the land bare and prone to soil erosion hence land degradation. Miners cut down trees around the mining areas to be able to create space and for their excavation activities and some for fuel used in their mining activities. This decreases the productivity of land and hence increasing the vulnerability of the population by increasing the rate of food security.

From the results, the participants revealed a moderate threat of artisanal mining to crops and farmlands indicated by a mean of 3.318 (std. dv = 0.075). However, they also revealed that there is a low rate of increased release of dust from the mines as presented by a mean of 2.443 (std. dv = 0.148). In addition, a moderate rate of noise pollution from the mines shown by a mean of 2.125 (std. dv = 0.066). In addition, indicated by a mean of 2.218 (std. dv =0.163), the participants revealed a low rate of physiological disorder of crops.

The participants indicated that there is a low rate of air pollution as a result of artisanal mining with a mean of 2.208 (std. dv = 0.079). A mean of 2.170 (std. dv = 0.180) indicated a low rate of

noise and ground vibration as a result of artisanal mining. According to Funoh (2014), one of the main effects of ASM is soil degradation and land damage. Abandoned mining pits without reclamation or even refilling the pits act as breeding ground for mosquitoes and risky to animals and eventually no vegetation grows around the area.

The participants revealed a low rate of environmental disaster/ deaths as a result of artisanal mining as indicated by a mean of 1.990 (std. dv = 0.915). A mean of 1.862 (std. dv = 0.889) indicated that participants agreed that there is a low rate of pollution of water bodies as a result of surface mining. Further, with a mean of 1.709 (std. dv = 0.865) the participants indicated a low rate of water being polluted as a major environmental problem due to mining. The participants revealed a low rate of waterborne diseases as by a mean of 1.699 (std. dv = 0.907). With a mean of 1.682 (std. dv = 0.847) respondents indicated a low rate of a potential health risk as a result of water pollution through mining. In general, the results show that soapstone mining in Tabaka has minimal negative environmental effects. This agrees with Fisher *et al* (2019) who concluded that manganese mining in West Timor, Indonesia is not as disastrous as artisanal gold mining taking place in other regions of the country. They also noted that the negative effects were easily reversible by the planting of cover crops.

4.6.4 Protection of Vegetation from Negative effects of Mining

Measures taken to minimize the negative effects of mining were part information reqired from the respondents. From the results, the respondents revealed that they practice reclamation or refilling the pits after mining. This is because if the pits are left unfilled, they may act as hideout places for mosquitoes hence leading to the spread of malaria. Funoh (2014) argues that ASM is a major contributor to soil degradation and land damage. Abandoned mining pits without reclamation or even refilling the pits act as breeding ground for mosquitoes and risky to animals and eventually no vegetation grows around the area.

Besides, several indigenous trees and shrubs were found to be cleared to create space and provide raw materials for building shelters for the miners in Taita Taveta in Kenya. Further, the participants also revealed that they plant indigenous trees to retain vegetation growth. They also make terraces and build gabions to prevent soil erosion. Further, the respondents revealed that they plant nappier grass together with other vegetation where mining has taken place and refilling has been done. In addition, the participants indicated that they practice re-forestation.

Plate 4:2: Reforestation in Tabaka

Source: Research Data (2020)

4.6.5 Family Members Working in the Mines

The participants were requested to specify how many of their family members work in the mines. From the results, 67.5% indicated that the number of their family members working in the mines was between 1 and 2 members. Further, 25% revealed that the number of family members in the mines was between 3 and 4 members, 2.7% indicated between 5 members and 6 members. In addition, the same per cent (2.7%) indicated between 9 members and 10 members while 1.8% per cent indicated between 7 members and 8 members. Table 4.16 represents the findings.

Table 4.166: Family Members Working in the Mines

Family Members	Frequency	Per cent
1-2	195	67.5
3-4	73	25.3
5-6	8	2.7
7-8	5	1.8
9-10	8	2.7
Total	**289**	**100.0**

Source: Research Data (2020)

4.6.6 Symptoms Experienced by the Participants

The participants who had observed or suffered some ailment as a result of working or living close to the mines were further requested to highlight the symptoms they had experienced. The results were as presented in Table 4.19. From the results, 52.9% of the participants indicated back pains, 22.1% indicated headache, 16.6% indicated coughing while 1.3% of the respondents pointed out infectious diseases. These results match the findings of Obiri *et al* (2016) who revealed that the rate of water pollution, ailments like coughing and back pains has increased as a result of mining in the Tarkwa Nsuaem Municipality in Ghana. As such, most of the traditional water sources had been contaminated and was not fit for human consumption and also a decline in farmland as mining activities increased in the area.

Table 4.177: Symptoms Experienced by the Participants

Symptom	Frequency	Per cent
Coughing	48	16.6
Infectious disease (the common cold and tuberculosis)	4	1.3
Back pains	153	52.9
Headaches	64	22.1

Source: Research Data (2020)

4.6.7 Ailments Resulting from Mining Activities

The data on any ailments observed resulting from mining activities was. 54.3% of the participants indicated yes, while 45.7% indicated no. This implies that most of the respondents had experienced some kind of ailment as a result of working or living close to the mines. This is shown in Figure 4.9

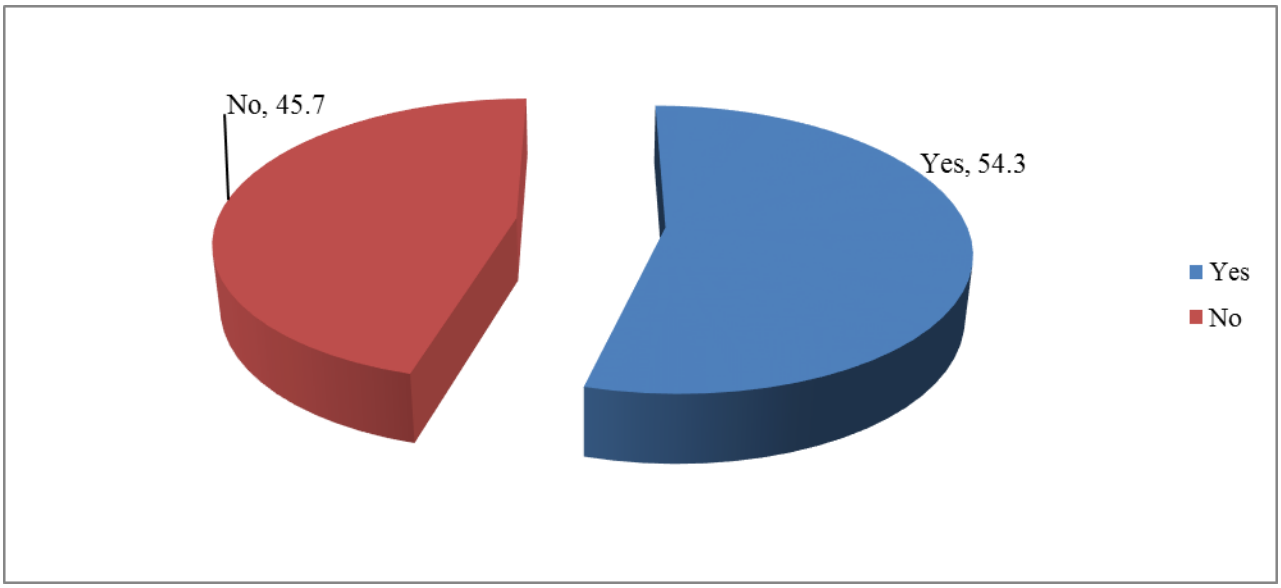

Figure 11.9: Ailments Resulting from Mining

Source: Research Data (2020)

4.6.8 Loss of Family Member as a Result of Mining Activities

Data on any loss of life while working in the mines and results represented in Figure 4.10. 82% of the participants indicated that they had not lost any of their relative or family members as a result of mining activities while 18% indicated they had lost their relatives. This implies that however manual and risky the activities in the mines are, the number of deaths experienced is minimal.

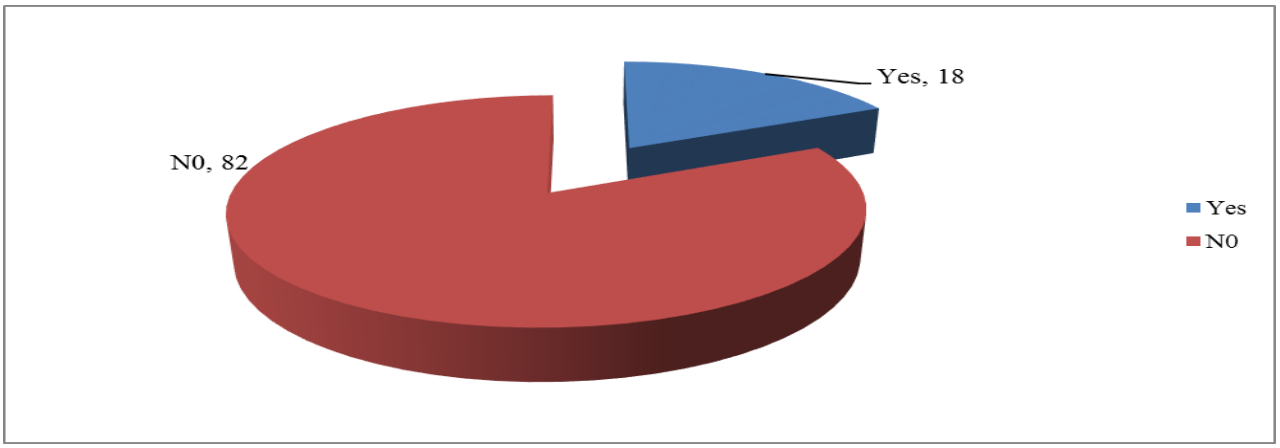

Figure 12.10: Loss of Family Members as a Result of Mining Activities

Source: Research Data (2020)

4.6.9 Correlation Analysis for Environment Effects of Artisanal Mining

Spearman Rank-order correlations analysis was used during this study to determine the relationship between environmental effects and artisanal mining in Tabaka, Kisii County. As illustrated in Table 4.20, artisanal mining has a negative and significant influence on environmental activities (r=-0.285, p value =0.000). The association was significant since the p value (0.000) was less than 0.05 which is the significant level. Therefore, the null hypothesis that artisanal mining has no significant environmental effects in Tabaka, Kisii County.should be rejected. The findings are in agreement with Djibril *et al.,* (2017) findings that artisanal mining influences environmental activities negatively. Miners cut down trees around the mining areas to be able to create space and for their excavation activities and some for fuel used in their mining activities. This decreases the productive potential of the land and hence increasing the vulnerability of the population by increasing the rate of food security.

Table 4.188: Correlations Coefficients

			Environmental effects	**Artisanal Mining**
Spearman's rho	Environmental effects	Correlation Coefficient	1.000	-.285**
		Sig. (2-tailed)	.	.000
		N	289	289
	Artisanal Mining	Correlation Coefficient	-.285**	1.000
		Sig. (2-tailed)	.000	.
		N	289	289

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

Source: Research Data (2020)

4.6.10 Regression Analysis for Environmental Effects of Artisanal Mining

Multivariate regression analysis was used in determining the association between environmental effects and artisanal mining.

The multivariate regression model was as follows:

$$Y = \beta_0 + \beta_1 X_1 + \varepsilon$$

Where; Y = is the dependent variable (Environmental effects), β_0 = Constant Term; β_1 = Coefficients of determination; X_1= Artisanal mining, and ε = error term.

The R-squared was used to illustrate the variation in the dependent variable (Environmental effects) that could be explained by the independent variable (Artisanal mining). The R squared was 0.746 and this implied that 74.6% of the dependent variable (Environmental effects) could be explained by independent variables (Artisanal mining).

Table 4.1919: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.864	.746	.741	.45633

a. Predictors: (Constant), Artisanal Mining

Source: Research Data (2020)

The ANOVA was used to assess whether the model was a good fit for the data. As depicted in Table 4.22, the F calculated 29.897 was higher than the F critical value 2.559. Besides, the p value (0.000) was less than the significant level (0.05) and hence the model could be used in explaining the influence of independent variables (Artisanal mining) on the dependent variable (Environmental effects). Hence, the model was a good fit for the data.

Table 4.200: Analysis of Variance

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6.226	1	6.226	29.897	.000[b]
	Residual	59.764	287	.208		
	Total	65.990	288			

a. Dependent Variable: Environmental effects

b. Predictors: (Constant), Artisanal Mining

Source: Research Data (2020)

The regression equation was;

$Y = 1.512 - 0.260X_1$

The results revealed that artisanal mining has negative environmental effects in Tabaka (β_1=-0.260, p value= 0.000). The null hypothesis that states that Artisanal mining has no significant

environmental effects in Tabaka, Kisii County should be rejected because the significant level (0.05) was greater than the p value (0.000). This implies that artisanal mining leads to minimal negative environmental effects in Tabaka. This is in line with Fisher et al (2018) who noted that environmental effects of manganese mining in West Timor, Indonesia was negligible, and the shocks would be parceled out with using simple farming techniques.

Table 4.211: Regression Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.512	.195		7.741	.000
	Artisanal Mining	-.260	.048	-.261	-5.468	.000

a. Dependent Variable: Environmental effects

CHAPTER FIVE

5.0 SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter provides a summary of the study's findings, conclusions and recommendations, along with recommendations for additional study.

5.2 Summary of Findings

5.2.1 The Nature and Extent of Artisanal Mining in Tabaka, Kisii

It was noted that according to the county government, the soapstone mining in Tabaka is an illegal activity however the relevant authorities are working on coming up with best way to work with the individual private owned mining sites. The mining process involves clearing the top vegetation in the area where the soapstone is suspected to be, then followed by executing the topsoil and removing the rest of the soil using tools and equipment like mattocks spade metal iron. The soapstone is then excavated using tools like chisel, hammer and machetes.

Transportation of the excavated rocks to the working areas is done manually Once the soapstone is excavated by the miners, it is taken to the artisans who come up with the sculptures i.e., animals, people sculptures after which the sculptures are made using a subtractive method which uses various tools like machetes, chisels and knives. The sculptures are then decorated by being colored or polished then considered ready for sale.

Further, the study found that the amount of soapstone mined in Tabaka mines per week is less than 10 tones. From the results, it was found that for one to start mining at Tabaka he/she should be willing to start mining. One should have access to a quarry and required tools/equipment together with labor. These tools include saws, machetes, hoes, and axes among others. Further, capital is a key requirement for one to start mining. The capital is used to cater for the expenses involved in mining the soapstone, transportation among other costs. One should also have the skills and knowledge of soapstone markets and prices.

5.2.2 The Socio-Economic Effects of Artisanal Mining in Tabaka, Kisii.

According to the findings, it presented a positive and significant socio-economic effect of ASM at Tabaka.The study found that the people engaged in mining soapstone in Tabaka area are part-time students, retired people and both employed and unemployed. The family of artisanal miners ranged between 3 members and 5 members. Further, it was established that most of the miners in Tabaka have been mining for the last ten years. The study found that most artisanal miners in Tabaka live about 500 meters away from the mines and they spent less than Ksh 50 on transportation per day.

The study revealed that before joining mining activities most of the people were earning less than Ksh 100 per day, however, after the advent of mining most of the people are now earning between Ksh200 and Ksh 400 per day. From the survey, it was established that through soapstone mining the miners can cater for their basic needs (Food, lodging and clothing) and pay school fees for their children.

The study found that there is an increase in monthly income levels propelled by artisanal mining. Further, it was found that the rate of poverty reduction is high due to income from artisanal mining. However, the study discovered that there is a high rate of reduced farming land as a result of artisanal mining. In addition, it was found that even though artisanal mining is rapidly growing, there is still a low rate of expansion of industrial and commercial activities

The survey found that artisanal soapstone mining has contributed to the declension of other societal activities e.g., change in lifestyle and land conflicts. In addition, some of the miners are too busy with mining to an extent of forgetting their roles in the family and indulge in alcoholism. Further, through artisanal mining, there has been an increased rate of school dropouts as it provides quick returns.

Further, the findings showed that the land price in the area is increasing at a high rate because of the mining activity. The study also found that there is a sharp rise in house rent due to artisanal mining. From the findings, it was found that there is a high influx of immigrants and visitors in the area.

5.2.3 The Environmental Effects of Artisanal Mining in Tabaka, Kisii

The results revealed minimal negative effects of artisanal mining on the environment in Tabaka. In addition, it was found that the rate of deforestation was high in the Tabaka region owing to artisanal mining activity. Further, it was found that there is a high rate of land degradation (soil erosion) due to excavation. In addition, there is a high rate of land and vegetation degradation due to artisanal mining. It was also found that artisanal mining has contributed to an increase in rock waste and debris. The study also found that artisanal mining poses a threat to farmland in Tabaka area.

The study established that artisanal mining has led to increased destruction of the land space whereby most of the mines are left uncovered hence hindering farming activities. Further, the participants indicated that artisanal mining has led to stagnation of water in the mining areas. However, the study revealed that some residents in Tabaka area plant indigenous trees to retain vegetation growth. In addition, it was found that some residents practice re-afforestation.

The study revealed that most people involved in artisanal mining have observed or experienced certain health problems due to soapstone activity. Among the symptoms experienced by the miners include back pains; headache and coughing the most common being back pains due to the extensive manual labor in the mines. The study also revealed that the number of deaths in mining activities was very low.

5.3 Conclusions

The study concluded that the socio-economic effects of artisanal small-scale mining in Tabaka were positive and significant. The artisanal mining activities (Excavation, tunneling and digging, minerals extraction and processing, the concentration of minerals, transportation of minerals and marketing of mineral products) lead to improvement in infrastructure provision, Income generation, Job creation and poverty reduction and health effects. However, the artisanal mining activities lead to increase in school dropouts and population growth in the area.

Further, it concludes that there is a minimal negative environmental effect of artisanal mining in Tabaka, These environmental issues can be dealt with better mining techniques and rehabilitation of the land once the mining activities are over in specific pits.

5.4 Recommendations

5.4.1 Recommendations to the County Government of Kisii

The study noted a low investment in terms of technology and ICT. Therefore, it recommends that training should be conducted on better ways to incorporate ICT in marketing of their products.

It was also found that most miners are exploited by the middlemen who buy soapstone products at low prices. This study, therefore, recommends that clear regulations to govern issues on soapstone industry, which control the mining, buying, selling of raw stones and finished product, to be created. In addition, the County Government of Kisii should come up with ways of promoting the community's culture to promote tourism.

5.4.2 Recommendations to the Regulatory Institutions Such as NEMA

The study found that deforestation is very high due to artisanal mining. Therefore, this study recommends that regulatory bodies conduct sensitization sessions on good mining practices to minimize negative effects

Findings revealed that some residents have lost some of their relatives while working in the mines. It is therefore recommended that regulatory bodies come up with good management structures that will be all inclusive monitor the mining and advise owners of the mine accordingly to avoid accidents that may result from quarrying.

5.4.3 Recommendations to the Residents and Community Members

The findings revealed that most of the miners are exploited by the middlemen. This study, therefore, recommends that the residents and the miners should form groups for selling their products to minimize exploitation by the middlemen. Further, they should explore other alternative livelihood like agriculture to enhance the food security of the area and also come together as a community to protect their culture to attract more tourists to the area.

The study found that most of the mines are left bare. The study recommends that the residents and the community ensures that mine reclamation is done by covering the mining pits and planting cover crops to prevent the spread of diseases and minimize risks.

5.4.4 Recommendations to the Government of Kenya

This research establish that Tabaka area has a great economic potential that can contribute more to the economy of the locals and the country. However, as at now, the soapstone mined is used for sculpturing and the rest is waste. For total maximization of soapstone and job creation, this study recommends that the Government to open value addition factories that will utilize the available resource with minimal. For example terrazzo plant and ceramics plants.

Further, the Government should establish relations with other countries to open up more markets both locally and internationally and ensure better prices of sculptures and carving. This will ensure the miners are not exploited by the middlemen.

5.5 Suggestion for Further Studies

The primary goal of the research was to evaluate socio-economic and environmental effects of artisanal soapstone mining in Tabaka, Kisii County. However, the study only focused on soapstone as the resource. As a result, it recommends that studies be done focusing on other natural resources and their impacts.

Furthermore, the study focused on socio-economic and environmental aspect only. However, it was noted that residents spend too much time working in the soapstone mines and other soapstone related activities and therefore recommends a study to be done to check on how the prolonged exposure to fine dust particles of soapstone affects their health.

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APPENDICES

Appendix I: Questionnaire

I am a student at the University of Nairobi pursuing a Master of Arts Degree in Environmental Planning and Management. I am conducting a study an **Assessment of the Social-Economic and Environmental Effects of Artisanal Mining in Tabaka, Kisii County.** I am kindly requesting for your time to answer some questions. The information you will provide shall be solely be used for academic purposes.

Section A: Demographic Characteristics

1. Kindly indicate your Gender

   Male [ ] Female [ ]

2. Kindly indicate your age (years) …….

3. What is your highest level of education?

   No formal education [ ] Primary Education [ ]

   Secondary Education [ ] Diploma [ ]

   Undergraduate Education [ ] Postgraduate Education [ ]

4. Marital status

   Married [ ] Divorced [ ]

   Separated [ ] Single [ ]

   Others(specify) …….

5. Which one of the options describes you

   Native [ ] Migrant [ ]

6. What do you do in Tabaka mine

   Digging [ ] Using soapstone in Sculpturing [ ]

   Excavation [ ] Marketing soapstone products [ ]

   Carrying soapstone [ ] Security [ ]

Others(specify) …….

Section B: Artisanal Mining

7. Can you describe how you process soapstone from the mine?

   ……
   ……
   …….....

8. What is the amount of soapstone that is mined in Tabaka weekly?

   ……..

9. What is required for someone to start mining in Tabaka?

   ……
   ……

10. To what extent do the following artisanal mining activities relate to soapstone influence social, economic and environmental characteristics of Tabaka?

	Very high	**High**	**Moderate**	**Low**	**Very Low**
Excavation, Tunneling and digging					
Minerals extraction and processing					
Concentration of minerals					
Transportation of minerals					
Marketing of mineral products					

Section C: Socio-economic Effects of Artisanal Mining

11. What was your household income per day (Ksh.) before mining? ……

12. What is your household income per day (Ksh.) after advent of mining? ……

13. What is your current employment status?

    Unemployed [ ]

    Employed [ ]

Retired [ ]

14. Do you live in your house?

Yes [ ] No [ ]

15. If no, how much rent do you pay monthly? ……

16. What is the distance (in kilometers) from where you live and the mine? …….

17. What is the estimate of your transportation per day to the mine ……

18. What is your current occupation apart from working in the mines?

None	[ ]	Agriculture	[ ]
Petty trading	[ ]	Livestock keeping	[ ]
Fishing	[ ]	Brick making	[ ]
Poultry Keeping	[ ]	Charcoal producer	[ ]
Construction worker			[ ]

Others (specify) …….

19. What do you do in Tabaka mine?

Digging	[ ]	Using soapstone in sculpturing	[ ]
Excavation	[ ]	Marketing soapstone products	[ ]
Carrying soapstone	[ ]	Security	[ ]

Others (specify) …….

20. How do you rate with the following economic effects of artisanal mining of soapstone in Tabaka?

	Very high	**High**	**Moderate**	**Low**	**Very Low**
Provision of market for farm produce					
Abandonment of farms					
Reduced farming land					
Provision of market for farm produce					
Increase monthly income					
Job creation					
Expansion of industrial and commercial activities					
Reduction of poverty					

21. How do you rate with the following social effects of artisanal mining of soapstone in Tabaka?

	Very high	**High**	**Moderate**	**Low**	**Very Low**
Changed lifestyle of dressing					
Conflict between indigenous and migrant workers					
Drop in school enrollment					
Schools absenteeism					
Improved supply of electricity					
Increased land prices in the area					
Improved healthcare					
Increased house rent prices					
Increase in the crime rate					
Improvement in the living standards					
Influx of immigrants and visitors in search of jobs					
Increase in alcoholism and prostitution					

22. Apart from above, which are othersocio-economic effects of artisanal mining?

……..……

……..……

……..……

Section E: Environmental Effects

23. How do you rate the change in the color and smell of water bodies?

Improved [ ] Unchanged [ ]

Deteriorated [ ]

24. What is the state of drinking water quality in Tabaka?

Good [ ] Bad [ ]

Fair [ ]

25. How do you rate with the following environmental effects of artisanal mining of soapstone in Tabaka?

	Very high	**High**	**Moderate**	**Low**	**Very Low**
Noise and Ground vibration					
Increase release of dust from the mines					
Air pollution					
Chemical pollution					
Environmental disaster/ deaths					
Physiological disorder of crops					
A threat to crops and farmlands					
Land and vegetation degradation					
Water pollution as a major environmental problem due to mining					
Likely to have disease due to drinking water					
Water pollution mentioned as a potential health risk					
Surface mining pollutes water bodies					

If surface mining operations stop water pollution in the community would cease					
Noise pollution from the mines					
Deforestation					
Degradation of land (soil erosion)					
Rock waste and debris					

26. What do you do to protect the forest environment from the negative effects from mining?

……

……

……

27. Apart from above, which are the other environmental effects of artisanal mining?

……

……

……

28. How many members of your family work in the mines? ……..

29. Kindly indicate any disease that might have resulted from the mining?

Pulmonary disease [ ] Infectious disease [ ]

Skin rashes [ ]

Others (specify) ……

30. Has there been any loss of a relative or family member as a result of mining activities?

Yes [ ] No [ ]

Section F: Recommendations

31. What do you recommend the government of Kenya should do to ensure the sustainability of artisanal mining in Tabaka?

……

……

32. What do you recommend the County government of Kisii should do to ensure the sustainability of artisanal mining in Tabaka?

……

……

33. What do you recommend the residents and community members should do to ensure the sustainability of artisanal mining in Tabaka?

……

……

34. What do you recommend regulatory institutions such as NEMA should do to ensure the sustainability of artisanal mining in Tabaka?

……

……

Appendix II: Interview Guide

1. Who are the owners of the Tabaka mines?
2. Which are the main factors influencing artisanal mining in Tabaka?
3. What are the socio-economic effects of artisanal mining in Tabaka, Kisii County?
4. What other economic activities practiced in Tabaka apart from mining?
5. What are the environmental effects of artisanal mining in Tabaka, Kisii County?
6. What is the role of the National Environment Management Authority (NEMA) in terms of mining?
7. Does the National Environment Management Authority (NEMA) issue any licenses to the miners?
8. What are the common inputs used in the mining process?
9. What are the dangers associated with Tabaka Mines?
10. What are some of the challenges faced in Tabaka Mines?
11. What are your recommendations on the ways to ensure sustainable artisanal mining in Tabaka, Kisii County?