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FACTORS HINDERING ENVIRONMENTALLY SUSTAINABLE MINING IN MKUKI, TAITATAVETA COUNTY

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ABSTRACT

This paper purposed to find out the factors hindering environmentally sustainable mining in Mkuki, to come up with effective solutions, while applying environmental engineering concepts. The focus was on why artisanal and other small scale miners in Mkuki region, Taita Taveta County have failed to practice environmentally sound and sustainable mining, and how environmental engineering can be applied to provide effective solutions to the case. The research employed primary methods for data collection, using both quantitative and qualitative approaches to data analysis. Focus groups and surveys were used to collect data from the local miners. The research's findings indicated that the lack of government support and the fact that miners lacked knowledge of what sustainability mining is were the major hindrances to environmentally sustainable mining. Thus it was concluded that having know-how of sustainability management in mines and government coming in to support the gaining of the said knowledge is crucial towards realising sustainable mining in Mkuki. Thus, it was recommended that awareness should be created through community gatherings, local newspapers, and even local media stations of the concept of sustainability and its importance. Capacity building and education of the local communities through workshops and training would also be crucial towards realizing sustainable mining in the region.

KEYWORDS: Hinder, Sustainable, Artisanal mining, Environment.

Contents

INTRODUCTION

BACKGROUND

Mkuki is approximately 60KM from Voi, via Mwatate town. The area is rich in gemstones, which has encouraged widespread artisanal and small scale mining. The mining of gemstones happens in a wide range of geological contexts. Finding gemstones and their extraction is one feat that is quite challenging and which often is not profitable as a result of the different engineering and geological difficulties that are faced in the exploration and extraction stages of the mineral. A small gemstone could either be worth hundreds of thousands of shillings or nothing, practically. This is something that sets out gemstones

from other different minerals. The classification of gemstones is usually on the basis of their composition chemically, crystal structure, refraction and optical characteristics. Different types of gems have different listed prices: Jeremejevite goes for $2,000 per carat, fire opal goes for $2,300 per carat, poudretteite goes for $3,000 per carat, benitoite $4,000 per carat, musgravite $6,000 per carat, red beryl $10,000 per carat, alexandrite $12,000 per carat, diamonds $15,000 per carat, serendibite $18,000 per carat, grandidierite $20,000 per carat, taafeite $35,000 per carat and red diamonds at $1,000,000 per carat(Nace, 2015).

Gemstones are formed through geological processes in the earth`s crusts rocks and in the upper mantle. The gemstones and rocks that are today found on the earth`s surface were buried deep in the mantle and crust of the earth millions of years ago under conditions that facilitated the formation and transformation of rocks and gemstones (Saul, 2018). At times, when rocks are brought the surface of the earth as a result of erosion, within those rocks, ores and gem materials are found.

Some of the precious stones that are mined across Taita Taveta include green garnets (Tsavorite), red garnets, sapphire, rhodolites, tourmalines and Ruby among others. Up to 60% of the annual production of gemstone in Kenya is reliant on artisanal mining with the youths and women playing a key role.

The term artisanal mining is widely used to denote all smale scale mining that could either be informal and illegal or legal (Verbrugge and Besmanos, 2016). What best characterises artisanal mining is the use of rudimentary techniques for mining coupled with absence of long-term planning. Rudimentary techniques are used by these artisanal miners for extraction of minerals and the mining often happens under conditions that are highly disorganised, hazardous and labour intensive.

JUSTIFICATION

These mining activities, as mentioned in the introduction, adversely impact the environment, particularly around the mines, and thus the need for environmental initiatives in encouraging environmentally sustainable mining. Despite efforts by the Kenyan government to ensure that miners are concerned with environmental protection during mining, it is evident that miners in Mkuki do not practice environmentally

sustainable mining, and thus the need to address the problem, as it can lead to environmental degradation.

AIM

This study aims to identify the different factors that hinder sustainable mining in Mkuki, TaitaTaveta County.

OBJECTIVES

1. To familiarize with practical issues as regards sustainability management in Mkuki,
2. To find out the factors hindering environmentally sustainable mining in Mkuki, and
3. To come up with recommendations, while applying environmental engineering concepts, to initiate effective solutions.

LITERATURE REVIEW

Environmental sustainability of mining

A large number of natural resources are used in the mining industry and these include soil and water. While the industry makes a vital contribution to Kenya`s economy, it could also be damaging to the environment. For mining to be environmentally stable, there are several factors that would need to be checked and these include;

1. Reduction of outputs – different materials like mine water, solid waste and air particles are produced during mining. Gorman and Dzombak (2018), posit that plans for management of waste are necessary for prevention of water, air and soil pollution. Use of sustainable equipment in gemstone mining could help reduce waste output.
2. Proper disposal of waste – the environmental impacts of gemstone mines could be curbed through establishment of proper waste disposal mechanisms. According to Kokko et al., (2017), it is possible to reuse water in the mines, for instance, the

little water available could be used and reused for washing ores and equipment respectively.

3. Closing and reclamation of mines that have been shut down – a hazard is presented through the allowing of mines that have been shut down to continue standing open (Schoen berger, 2016). Often, waste that is hazardous in the form of dust and rock waste is left in these mines which when left unchecked leaks into the underground water tables or even comes close to animals and human beings who leave nearby. Illegal mining activity could also come about from these shut-down mines.
4. Replenishment of the environment – miners commonly over look the importance of environmental replenishment. The simple act of environmental replenishment could go a long way in increasing mining`s environmental sustainability. Through restoration of the environments through the mines, mining companies would be contributing to environmental change that is positive. The process of reclaiming a mine that has been shut down should include steps like planting of tress, removal of hazardous materials and restoration of the topsoil.

Barriers to environmentally sustainable mining

There are limited studies that explore the hindrances to environmental sustainability mining. This paper identifies different factors that hinder environmental sustainability and relates them to mining.

De Medeiros, Ribeiro, and Cortimiglia (2014), identify social barriers as some of the hindrances to sustainability. The continued growth of population, together with consumption that is not sustainable and the patterns of production of the wealthy are some of the barriers to sustainability. Other social barriers include entrenched inequities, marginalisation of the poor ad limited awareness about sustainability are other social barriers.

According to Yi, Feiock, and Berry (2017), poor systems of monitoring and evaluation are also a hindrance to sustainability. Lack of specific targets presents a basic problem together with the absence of measurements that are able to track progress. That deprives decision maker's important information that could have been used to promote

sustainability. Voß and Kemp (2015) recommend the strengthening of systems for monitoring and evaluation to facilitate the establishment of processes for improvement that are dynamic and that are effective.

The nature of most artisanal mining in Mkuki is rudimentary whereby, explosives that are easily available are used in the breaking down of rocks in the search for gemstones. Basically, artisanal mining relies on simple tools, manual labour and is quite labour intensive requiring large numbers of miners to extract the gemstone.

Altomonte, Rutherford and Wilson (2015), identify human beings as the biggest stumbling block to sustainability of mining activities. Until such a time when this would be resolved, any positive developments would be reduced to nothing. Human beings and in this case, the miners, should place their thoughts and deeds in a straight line to ensure environmental sustainability. Most people especially in the developing countries, however, have a very poor understanding of the concept of sustainability and are not even aware of the different principles of sustainability. The gap between the rich and the poor is another hindrance to sustainability. The rich carry on with their activities with zero regard for the environment leaving the poor people in bad environmental conditions. The poor have minimal resources for dealing with such consequences. According to Bosselmann (2016), for sustainability to be achieved, evolvement of the concept of prosperity and human values would be necessary to a point where the quantities of dignity and equity are incorporated.

Bosselmann (2016), posits that different economic and political systems are only designed in such a way that they are able to only see what is close to the eyes. There is minimal interest among different stakeholders in thinking and caring about the future. The orientation of economic development is in such a way that more profits are promoted.

Lack of cooperation between the government and the local miners is another hindrance to sustainability. For sustainability to be achieved, it would be necessary that the government works closely with the locals and researchers, educationists and makers of policies to implement approaches for sustainability that are within the boundaries of the locals. Unfortunately, most countries have not prioritised sustainability. For sustainability in mining to be fully achieved, it would be necessary for all the involved stakeholders to accept wholeheartedly that sustainability is a necessity and make it their lifestyle.

Essentially, a common framework for benchmarking sustainability is required. Until such a time when we have a vision that is intuitive and a common platform for examination, planning, researching and scheduling of sustainability it would not be possible to achieve the sustainability vision.

METHODS

A thorough review was carried out for identification and further prioritisation of those factors that hinder sustainable mining in Mkuki, together with a physical survey of the area. Focus groups (3 groups, each consisting of 7 members) and surveys (40 locals were surveyed) were also used to collect data from the local miners to get their understanding of the issue of sustainable mining. Before the survey questionnaires were administered, the focus groups were held to examine the different factors that were identified in the literature review as regards their relevancy. The rationale for using the focus groups was that they provide an opportunity for the researcher to identify and understand in-depth the issues which most of the target population are not familiar with. With focus groups, it is easier, and provides a more one on one discussion with the locals and thus providing a clearer view of the practical issues they face as regards sustainability management in the mines, as opposed to just interviews. Furthermore, a survey was used to further provide meaningful data for analysis, concerning what the bigger part of the miners' population perceived the factors hindering sustainable mining to be.

RESULTS

The nature of artisanal mining was observed to be the most prominent hindrance for sustainable mining. Most of the miners operate illegally without permits and that makes enforcement of the environmental regulations difficult.

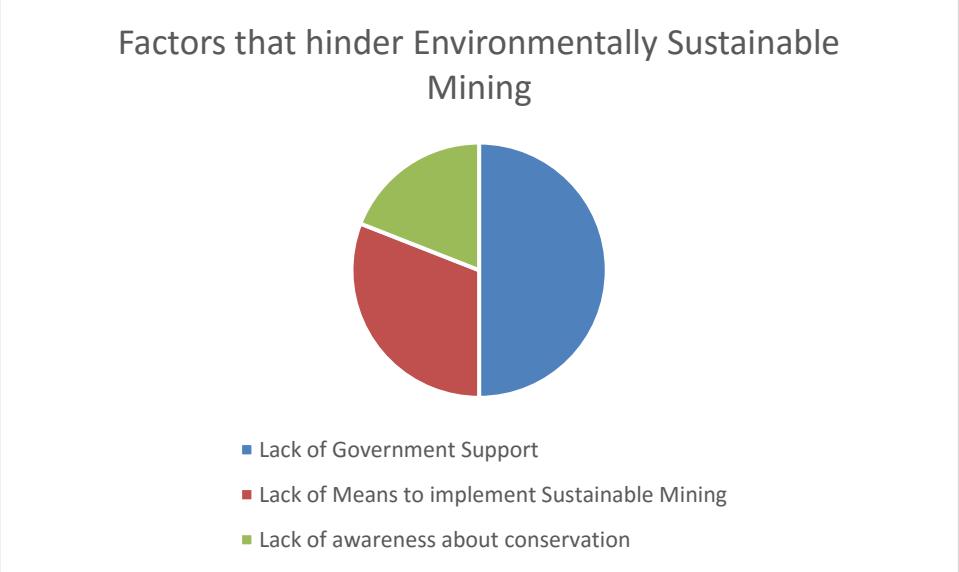

Figure 1: Factors that hinder Environmentally Sustainable Mining.

Lack of knowledge about environmental conservation was identified to be another prominent reason for the failure of sustainable artisanal mining. Most of the participants who were involved in the filling of questionnaires were not aware of the different principles of sustainable mining.

Lack of means to implement sustainable mining among the local miners was also identified as another hindrance to sustainable mining. There are a lot of brokers who contribute towards the workers at the mines, and miners as well receiving very little for their gemstones. These leaves the miners with too little to even think of practicing sustainable mining.

There was also observed the lack of enough support from the government to support environmentally sustainable mining. While the government of Kenya has even implemented an act that regulates mining, many miners still continue to operate without licences.

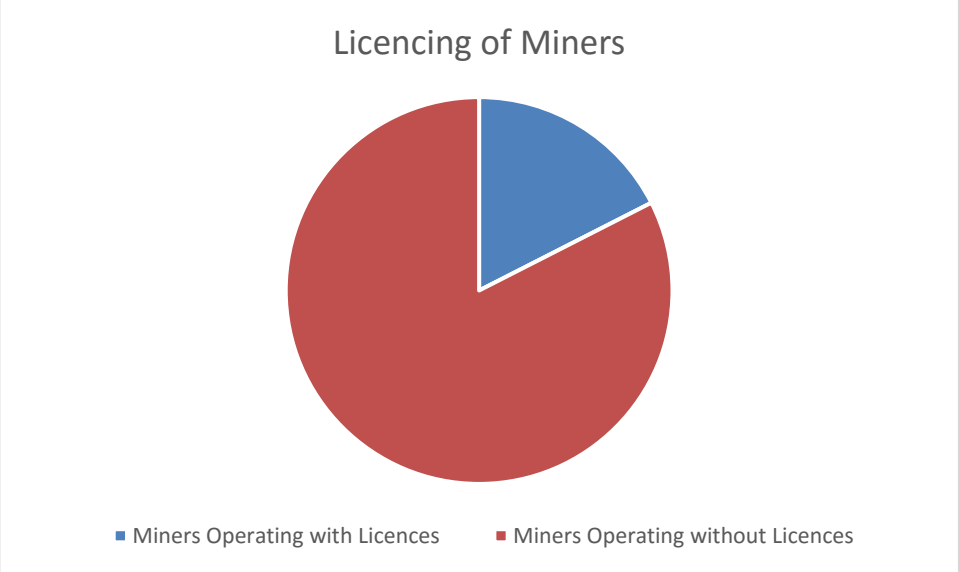

Figure 2: Miners who operate with licences.

The extraction of gemstones in Mkuki is from time to time accompanied by severe destruction of the environment through earth-cutting, deforestation, soil erosion, over-burden, water and air pollution, and hazardous waste generation-tailings. Environmental destruction costs are observed to even rise whenever forest cover is depleted for the mining to go on. The extinction of animal and plant species and loss of biological diversity also happen. Such losses tend to be permanent and irreparable.

The following environmental impacts were observed in the different mining sites that were visited in Mkuki;

1. Soil erosion – different methods of extraction open up the ground and eventually lead to the removal of top soil. In majority of the cases where artisanal miners are involved, the pits that are dug up are left open. The soil erosion is initiated by the digging of trenches and clearing of vegetation. When the rains come, the valuable soil nutrients are washed away as water runs through the openings. Eventually that brings about the siltation of the nearby rivers.
2. Physical disruption of the landscape which creates different physical hazards. The natural aesthetics of the Mkuki area are affected by the landscape changes.
3. Health implications which are a result of poor sanitation and poor hygiene – existing and potential gemstone mines are invaded by droves of artisans who bring about the normal problems of waste disposal. Evident impacts on natural

environments are brought about by need for different sanitary services like waste dumping sites and toilets.

4. Cutting of trees and clearing of bushes – to pave way for mining sites, different indigenous shrubs and trees are cleared. Baobab and acacia trees are quite common in Mkuki and it is worth noting that these are trees which require long periods of time to mature fully. Their continued cutting without replanting will eventually lead to their extinction in the area. Mining areas that are left unrestored are a serious source of problems from the environment and that have a direct effect the livelihoods of the ecology and communities that surround the mining are once the mining has been carried out.
5. Open pits, trenches and disused abandoned mines – often, when tunnels and pits are exhausted and not productive, the miners abandon them without caring to either reclaim them or cover them. A lot of dangers are posed by such open mines to both animals and human beings. The rain water collected in such pools provides breeding places for mosquitoes. Other reasons for living mines open include the inability of the miners to sustain their mines financially and carrying out of mining in land that is disputed. There are numerous pits that remain un-reclaimed and unfilled in Mkuki which were left behind after extraction of gemstone. The most common method used in artisanal mining of alluvial deposits is digging of pits. A huge percentage of the gemstone extracted in Mkuki is extracted by artisanal miners whose operations are largely outside the set legal frameworks using rather basic tools like sieves and shovels.
6. Pollution of the environment – a lot of dust, noise, toxic fumes and liquid and solid waste effluent are produced as a result of mining activities. All these are serious environmental pollutants.

All these are problems that when remediated, the communities could be able to benefit from the land again, in the future.

DISCUSSION

Awareness of sustainable mining

It was established that the different artisanal and small scale miners in Mkuki have no proper understanding of the concept of sustainable mining. That has seen the miners continue to carry out their mining activities ignorantly and with zero regard for the environment. It is also observed most of these miners are not even aware of the adverse effects their mining activities have on the environment.

There are two main pre-conditions for achievement of sustainability and these are mining enterprises that are self-regulating and that are viable economically, efficient technically and financially profitable and good governance (Schoenberger, 2016). The principles of sustainability are applicable to all the different stages of mining, namely; exploration, mine planning, construction, the actual extraction, closure of the mine, post-closure reclamation and rehabilitation. Examples of the sustainability principles applied here include the principles of scientific mining, intra and inter-generational equity, the principle of precaution and the principles of creating substitute capital in the form of physical and social infrastructure and engagement of stakeholders (Taheri et al., 2016).

The most disheartening thing about the mining in Mkuki is that the miners continue to lavish in poverty and there have also been significant damages on the environment. There is completely no concern for the environments carrying capacity in the regions mining operations. That has brought about avoidable pressure on the environment and also brought about numerous inconveniences to those people who live there.

Role of the government

The government of Kenya enacted the Mining Act of 2016 which was aimed at reinvigorating the country`s general mining sector through provision of clear guidance on the activities of mining in Kenya (KENYA ASSOCIATION OF MANUFACTURERS, 2019). Among other things, the Act legalised artisanal miners. While the act was also intended at streamlining the mining sector to promote conversation of the environment, in Mkuki,

the effort of the government to promote environmental conservation is not seen. It is worth noting that mining is not a devolved function in Kenya.

The government really needs to do more, and a more comprehensive view of sustainable development that has the capabilities of covering different dimensions and not just the environment should be put into consideration. These other factors include engagement of stakeholders and consultations, transparency in accountability and communication and local area development both socially and economically.

Exploitation of miners

The income that is earned in these mining activities is not even enough to relieve the burdens of environmental degradation. The situation in TaitaTaveta is made even worse by few individuals who continue to exploit the poor residents to work in their mines as they enrich them selves(Mkanyika, 2018). The local residents hence remain poor and are left to deal with pollution and degradation of the environment. The residents of Mkuki blamed their lack of skills for mineral excavation for their in exploiting the gemstones. As a result of skills and capital, majority of the local miners rely on the explosives that are easily available for breaking down rocks in their search for gemstones. The gemstone market is controlled by dealers who end up fleecing the poor miners and that is even despite the numerous environmental and health risks that are the miners face in the mining. Some of the miners receive only a paltry 200 shillings daily.

If the proceeds from the mining were properly tapped, they could be utilised to relieve the burdens of environmental degradation through activities like filling of pits. Refilling of pits is not a cheap activity and large amounts of money are required and that cannot be afforded by artisanal miners. This dynamic is often reinforced by the alluvial deposits short lifetime. It is necessary to refill pits because otherwise when left open, the land remains bare and cannot even be used for purposes of farming. Additionally, pits filled with water are breeding grounds for malaria causing mosquitoes which brings about even bigger problems for the residents of Mkuki.

Nature of gemstone secondary alluvial deposits

Another factor that hinders environmentally sustainable mining of gemstone in Mkuki is the nature of secondary alluvial deposits which in contrast to large primary deposits are usually scattered and relatively small. Such kinds of deposits are only interesting for artisanal miner`s rudimentary work methods, but not viable for large companies who mine on a large scale.

The nature of artisanal mining

Artisanal miners of gemstones are observed to frequently move between deposits as they search for gemstone deposits that could sustain their lives. The issues of economic benefits and management of resources become very critical in the mining of gemstone as a result of the short life span of the mining activities. With the emergence of new gemstone deposits in different parts of Africa like Mozambique, Tanzania and Madagascar, it has been observed that the engagement of artisanal miners of gemstone is an undertaking that is quite challenging.

In the artisanal mining context, the miners operate without legal permits which makes enforcement of environmental regulations quite hard. Additionally, it is also not possible to link past environmental destruction from mining to the specific companies and individuals who were responsible as a result of the lack of permits. It is not common that someone would years later be held accountable for environmental impacts that were linked to past mineral extraction activities. It is really not possible to implement the Kenyan mining permit regulations because of their nature which is ill-suited to the gemstone artisanal miners. Some of the regulations in the Mining Act include;

- Person shall not carry out artisanal mining operations unless they have artisanal mining permits.
- The CS mining shall designate representatives of the Director of Mines who shall be the heads of the county offices and who will report directly to the director of mines.
- Establishment of an Artisanal Mining Committee on every other county made up of a representative from the office of the governor who will act as the committee`s chairman, a representative of the Director of Mines who shall act as the secretary, three people

elected by the association of artisanal miners and who are not public officers, representatives of the Mining Ministry`s inspectorate division and a county land board representative.

Holders of artisanal mining licences are required to observe good mining practices, safety and health rules while also paying due regard to the environments protection. All these are requirements which the small scale miners of gemstone are not capable of meeting. These are people who are basically struggling to feed themselves and who really have no time for giving consideration to the health, safety and environmental guidelines.

The difficulties that are faced in the promotion of the environmental conservation and wider economic benefits at a local level is exemplified by the 2009 murder of Campbell Bridges. Mr. Campbell who during his lifetime was a small scale tsavorite gemstone miner was a strong supporter of the Tsavo regions environmental conservation(Ali, 2012). It was widely believed that his death had been a result of a mining dispute that involved Mr. Campbell and the locals.

CONCLUSION

There is still a lot that needs to be done to ensure that the mining of gemstone in Mkuki is environmentally sustainable. The different hindrances to environmentally sustainable mining that were identified include inactiveness of the government, the nature of artisanal mining, flow of very little money to the artisanal miners and the nature of secondary alluvial gemstone deposits. When these factors are solved, the government would be keener on regulation, more profits would flow to the miners and sustainable mining methods would be adopted even in the small mines.

The government has been rather lax on the issue of gemstone mining in Mkuki because the mining committees are not even active there. Most of the miners are not even aware of their existence.

RECOMMENDATIONS

To ensure that mining activities are environmentally sustainable, it would be necessary to create awareness through community gatherings, local newspapers and even local media

stations of the concept of sustainability and its importance by the national government working in close collaboration with the county government. Capacity building and education of the local communities through workshops and training would also be necessary. To overcome the different barriers that have been identified, different levels of the government would need to work together. It would also help to demonstrate the benefits of environmentally sustainable mining to the local communities. This could be achieved through demonstration of how different examples of sustainability could help overcome the different barriers that hinder the achievement of sustainability.

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Appendix: Focus Groups and Survey Questionnaire

Guide for Focus Group Discussions

1. What do miners perceive sustainable mining to be?
2. Are miners aware of the adverse impacts of mining activities to the environment?
    a. Or is it that income earned today is what matters the most? If so,
    b. Is this income enough to relieve the burden of environmental degradation (due to current mining activities) on these miners' future generations?
3. Have the miners been sensitized about sustainable mining?
4. Has the county government made efforts to educate minors on sustainable mining?

Survey Question

5. Why have artisanal and other small scale miners in Mkuki region, TaitaTaveta County failed to practice environmentally sound and sustainable mining? Rank the following reasons from the major (5) to minor (1).
    a. Lack of Knowledge (Don't know what it is)
    b. Lack of Means to Implement it (Know what it is, but don't have the ability to implement it)
    c. Lack of Government Support (In terms of education, sensitization, and funding)
6. In your own opinion, why do you think artisanal and other small scale miners in Mkuki region, TaitaTaveta County do not practice environmentally sound and sustainable mining? Please list from the major to the minor reason.