# Environmental and Socio-Economic Effects of Tanzanite Mining Activities in Mererani, Simanjiro District, Tanzania

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**Abstract**

*In Africa, minerals constitute the most valuable exports; however, mining activities have little contribution to the household economy and have adverse effects on the environment. The study on the assessment of the environmental and socio-economic effects of mining activities was done in Mirerani, Simanjiro District, Tanzania. A qualitative approach was employed in this study to analyze the problem under investigation. Purposive sampling and random sampling was used to obtain a sample size of 70 respondents. The collection of data involved questionnaire survey, interview and participants observation. Findings of the study showed that although mining activity is the main stay of the people residing in the district, this activity has meager contribution to the household economy and social development. In addition, deforestation, soil erosion, digging of pits, noise and dust, illegal hunting, flooding and production of rock wastes are the main types of environmental effects of Tanzanite mining activities within the district. This result calls for the Government of Tanzania to revisit the mining investment policies and laws to stimulate the economy and protect the environment surrounding the mining areas. This will increase the household economy of the people in Simanjiro district at the same time conserving the surrounding environment for the benefit of the country.*

***Keywords:*** Socio-economic Effects, Household economy, Environmental effects, Mining activities, Tanzanite, Tanzania

## Background Information

For past three decades there have been major reforms in the mining sector of the developing nations (Africa Development Bank (AfDB) and United Nations Economic Commission for Africa (UNECA), 2010; McMahon, 2010). At the same time the International Financial Institutions (IFIs) and the developing countries have placed a high priority to the development of the mining sector to meet the goal of improving the national socio-economic conditions, and ultimately reducing poverty (Belem, 2011 and Essaghah *et al.,* 2013). The growth of the mining sector was driven by the global paradigm which emphasized private sector-led development as the engine of economic growth in developing countries (AfDB) and UNECA, 2010). However, these goals have been challenged by the socio-economic and environmental effects of the mining industry to the society (Sinkala, 2009, Boyce and Emery, 2010).

Mining activities offer potential benefits to mining communities in terms of employment and social development but on the other hand it has been blamed for degrading the environment (United Nations Environmental Programme (UNEP), 2012; Kumar, 2015 and Caparros, 2011). A number of studies have found that instead of experiencing sustainable economic growth, developing countries have experienced worse economic condition regardless of having varieties of minerals (Akabzaa, 2009; Kitula, 2006, Shoko and Mwitwa, 2015). For example, Peru earns more than $2 billion per year from extractive industries such as gold and silver

mining, and the construction of natural gas pipelines but Peruvians do not benefit from the country's lucrative mining industry as half of Peru's population live in poverty (Oxfam America, 2009). Furthermore, Ghana is the second producer of gold in Africa but her multibillion dollar mining industry contributes less than 6% in the GDP (Twerefou *et al.,* 2015). Africa, the home to almost all minerals of the world, mineral constitute the most valuable exports of the continent, but the majority of her people live in growing poverty (Sinkala, 2009). Without more attention to regulating the socio-economic and environmental effects and ensuring clear economic gains, the mining boom could even worsen Africa's condition in the long run (Sinkala, 2009). Even in the thought of being successful countries, the socio-economic and environmental situations are still poor (Yirenkyi, 2008; AfDB and UNECA, 2010). According to statistics, copper and nickel mining in Botswana benefits the developed world more than its country of origin (Mazonde, 1986). In many developing countries, abundance of mineral resources has led to regional inequalities, corruption, conflicts, and wars of attrition (UNECA, 2009).

Tanzania is a country with abundant natural resources particularly minerals like Gold, Soda, Diamond, Tanzanite, Limestone, Coal, Silica Salt as well as Natural Gas and crude oil (UNEP, 2012, Mwihava et al., 2015). The exploration and production of minerals in Tanzania has been primarily focused on gold and diamond in Geita, Kahama, Shinyanga, Mara and the natural gas in Mtwara and Lindi regions. Being the only large scale gemstone mine in Tanzania, Tanzanite at Mirerani is traditionally extracted by small scale miners since it was discovered in 1967 (Ministry of Energy and Mineral (MEM), 2010). Exploration work conducted in 2002 indicated Tanzanite resources of 4.6Mt while re-evaluation of the deposits in 2004 indicating resources of between 0.95 and 1.26 Mt of ores with 63 and 83 million carats. In 2003, a large scale mechanized Tanzanite mine was opened at Mirerani.

Despite the notable growth of the mining sector in Tanzania in the last 15 years, stakeholders have been contending that the sector has failed to deliver the expected windfalls to the rest of the economy (Mwihava *et al.,* 2015; UNECA, 2008). Analysts criticize the depth and lack of linkages between the minerals industry and other sectors of the local economy, in particular, its contribution to the development of local small and medium-scale enterprises and the household income. Analysts further argue that the environmental and social effects associated with mining have not been appropriately accounted for and addressed. Compared to the growing body of literature focusing on the economic impacts of resource extracted at national levels, fewer studies have evaluated its potential socio-economic and environmental effects within the communities in proximity. Therefore, the present study is intending to analyze the Environmental and Socio-economic Effects of Tanzanite Mining Activities in Mirerani, Simanjiro District, Tanzania.

## Materials and Methods

### Study area

The study was conducted at Mirerani, Simanjiro District. Mirerani is situated between 3.87o south of the equator and 36.550E of Greenwich Meridian (Loserian *et al.,* 2002). Approximately, one third of the Simanjiro population lives in Mirerani are multi-ethnic mining community composed of a conglomerate of people from Tanzania and neighboring countries. The population of Simanjiro is 160,000 people and that of Mirerani is 47,109 (URT, 2014). The district is a semi-arid area with unreliable rains. Major economic activities are livestock keeping, crop farming, mining and petty trading. Due to unreliable rainfall, many people engage themselves in mining of tanzanite. Tanzanite mining in Mirerani is divided into four blocks. Block A, B, C and D. Block A is licensed to Kilimanjaro Mines Limited, Blocks B and D are reserved for small scale miners, while Block C belongs to Tanzanite One Mining Company Limited which currently is owned by the local and the United Republic of Tanzania (URT). Today, block D has been extended and owned

by Tanzanite Africa Mining Limited (Lange and Musonda, 2006). Regardless of the involvement of small scale miners in mining activities, their economic situation is worsening year after year. Thus, the study intended to assess the contribution of Tanzanite mining in enhancing household economy and the effect of mining activities on environment in the District.

**Research methods**

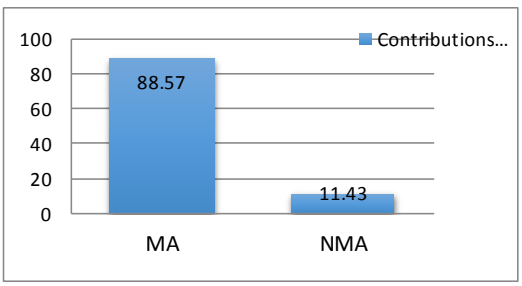
A qualitative approach in form of a descriptive survey research design was adopted to assess environmental and socio-economic effects of mining activities in Mirerani. Purposive sampling followed by simple random technique was adopted at various steps of the research to identify small scale miners and key informants. The selection of sample for the study considered the planning nature of the Mirerani sub-town with considerations to other factors such as population size, occupation of the people, the nature of Tanzanite mining and the nature of the Mirerani population which is concentrated in a small area. A sample size of 70 respondents was used whereby 10 respondents were the key informants, mainly village leaders, public offices, mineral officers and aged people while 60 respondents were household members and small scale miners in the study area. A household was taken to be a group of persons, who normally cook, eat and live together, and these people may not necessarily be related but have one person regarded as the head of house. These respondents were the primary sources of data collected through different methods including questionnaire survey, participant's observation and interview. Secondary data used in this study included a critical review both published and unpublished reports on environmental impacts of mining conducted in various places around the world and a review of relevant laws and regulations currently in force.

With the aid of SPSS program window version 16, descriptive analysis was carried out to analyze the primary information from respondents. Descriptive analysis assisted to assess the extent of local community participation in Tanzanite mining activities, the contribution of Tanzanite mining in enhancing household economy and the effect of mining activities in the study area.

**Results and Discussions**

**Contribution mining activities in the household economy**

Findings of this study showed that Tanzanite mining is the main contributor to the household economy as 88.57% respondents noted. The findings indicated further that the average monthly income of the people working at Mirerani area range between 30,000 Tanzanian shillings (Tshs) and 160,000 Tshs while a significant number of small miners (Wana-Apolo) claim that there is no monthly income (Figure 1).




Key: MA= mining activities,
NMA= non-mining activities

**Figure 1: Perceptions on contribution of mining to the household's economy compared to non-mining activities**

***Source:*** Clashon (2011)

**Contribution of non-mining activities in the household economy**

Non-mining activities also contribute to the household economy by 11.43%. People opened small businesses like shops, motorcycles (boda boda), bars, kiosks, lodges and rest houses. However, the survival of all these activities depends on mining. Within the surveyed mining community, the data indicate that small miners are not paid on monthly basis and there is no monthly payment as their income depends on the production in the mining field.

In terms of employment opportunities in the mining companies, Naisinyai village chairman said "there are only 43 people employed in TanzaniteOne Company of which 40 people are

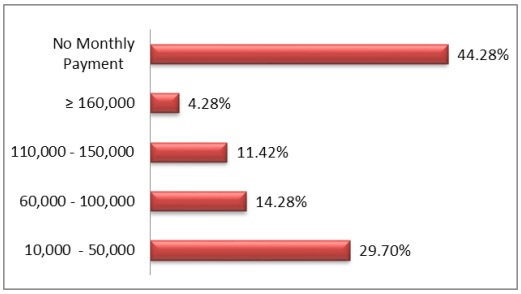



**Figure 2: Estimated monthly income of the respondents**

***Source:*** Clashon (2011)

from Naisinyai village where the TanzaniteOne plant is located and the other 3 are from other villages". Most of these people were in the security posts. According to the village chairman, Tanzanite Africa Mining Limited, a Tanzanian company, is paying as low as 81,000 Tanzanian Shillings per month. While in TanzaniteOne Company, the salary of the workers is 150,000 to 350,000 Tanzanian Shillings per month. This was also verified by the findings of the study as shown in Figure 2. In addition, there are complaints that mining companies do not employ local people from the mining areas (Personal communication with gate security)

**Socio-economic situations before and after the coming of the large companies**

The data of the study indicated that the socio-economic situation was better before the coming of big companies. This is true as 82.86% of the respondents noted that the former situation was better than the current when compared to only 1.43% of respondents who consider the current situation better than the previous (Figure 3). Mirerani is a small and disorganized township whose big population depends on mining activities for survival. Most of the people in the area are brokers, small miners, artisans, business men and middle men whose business depend on revenues from Tanzanite (participants observation).

Bianchini (2010) also supported these findings. In the report on mining industry and its impact on environment and health, he reported that the situation of Mirerani was better before the companies' took over as there was a good production of gemstone by Artisanal Small Miner (ASM) and the economy picked up well. At the local level, the industry shows great contribution to the household economy though not at the anticipated level. However, currently poverty is increasing due to lack of employment opportunities especially after the coming of foreign investors. Sinkala (2009) and Mwalyosi (2004) have a similar observation.

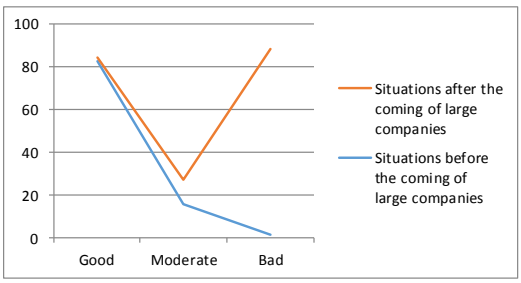



**Figure 3: Situation before and after the coming of large companies**

***Source:*** Clashon (2011)

**Social and physical infrastructures situation in Mirerani**

The findings of the study showed that in terms of social development of the Mirerani community, Tanzanite mining had little contribution since the area has only one rough road constructed and repaired by TanzaniteOne Company which also has a police post for security. The company has made meager contribution for the renovation of schools. The company provides drinking water only to Naisinyai village and for their livestock during dry seasons (participant's observation).

In the study area, there is a sort of imbalance in terms of social development as all infrastructures like hospitals; schools; police station and water supply are established in Naisinyai village only. Mirerani community has no clean water. People depend on the salty water from the wells dug by individuals which is sold at 50 Tshs per liter and clean water brought by trucks from Moshi town which is sold at 100 Tshs per litre (participant's observation).

Khaji (2014) argue that, despite being so rich in tanzanite ore, Mirerani is one of the poorest

and underdeveloped towns in Tanzania. The streets are covered with small old buildings (slums), rough roads with big potholes, old public vehicles which carry passengers from Mirerani to the nearest towns of Arusha and Moshi. The main means of transport within town are motorcycles which are a majority of the population while a few rich tanzanite dealers are seen roaming around the town.

**The effects of Tanzanite mining on the environment**

More than fifty percent (52%) of the respondents argued that Tanzanite mining affect the environment. Noise, dust, pits, wastes production, flooding, soil erosion, cutting of trees and illegal hunting are the major environmental problems resulting from mining. Other environmental effects resulting from Tanzanite mining activities are trafficking of cars and motorcycles, littering and land degradation (Figure 4).

These findings are supported by Sinkala (2009) who argued that, mining industry in Africa is challenged by the socio-economic and environmental impacts to the society. However it offers benefits to communities in terms of employment and social development but it has also been blamed for degrading the environment.

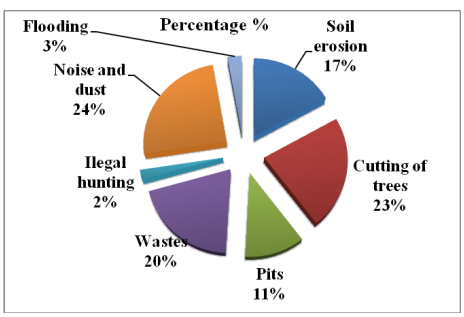



**Figure 4: Types of environmental effects of tanzanite mining**

***Source:*** Clashon (2011)

**Blasting noise and dust pollution**

Mining activities generate dust from blasting and excavation, during the drilling and the dumping of mine wastes over the surrounding area. Blasting noise of mining in Mirerani is one of the major environmental impacts of mining. The vibration caused by the blast of dynamite in the underground reaches the surface which causes not only noise but also cracks in the houses of the people who live at Naisinyai area. Another kind of pollution (noise and dust) comes from vehicles and motor cycles which are engaged in mining and related activities.

In nature, mining is destructive to the environment particularly with the development of science and technology. The use of advanced technological machines like bull dozers, cranes, dynamite and chemicals degrades the natural environment through producing waste materials, noise and dust (Bianchini, 2010, Priyadarshi, 2012). These activities produce noise and dust leading to erosion hence pollution. The tanzanite mining involves the use of blasting materials in the process of extracting minerals hence blasting from dynamite causes noise and vibration which affect the life of the people in the surrounding areas.

In Mirerani there is serious environmental degradation resulting from the mining activities that cause pile-up of huge volumes of soil and waste rocks. In TanzaniteOne mine, for instance, there is a rail from underground which brings the waste rocks to the surface. Small miners who always use low technology are also blamed to be destructive to the environment. Similar observations were reported by Donahue (2007), Vedasto (2009) and Betournay, (2011), UNEP, (2012) and Momo *et al.* (2013), in Africa, Asia and in South America.

**Wastes and pits**

The findings also show that the majority (80%) of the miners did not fill the pits when mineral were exhausted or following abandonment of the site and (16%) of the respondents said that they did fill pits after exhaustion or abandoning of mining while (4%) said they did not know. In Machekecho area where mining was conducted illegally, there was huge land degradation due to the presence of many pits and holes excavated in this area popularly known as “machekecho” or sieving place. This is a lowland area where many of the eroded material from the uplands

are deposited hence the soil is not compacted and therefore prone to erosion and sliding which makes it dangerous for the people to work (plate 1).

Furthermore data from the study showed that there are more than 700 pits which are between 100-200m (Figure 4). Northern zone mineral office report of 2008/2009 on the effect of mining in Northern zones indicated that there are 518 primary mining licenses, 8 gemstone mining licenses (GML) and 1 special mining license (SML) within TanzaniteOne. Each of these licenses may have up to six pits (shafts). For example, TanzaniteOne has six shafts which are Bravo shaft, Main shaft, Delta shaft, CT shaft, LHD shaft and Investors shaft. Mining in Block B and D is mostly still at artisanal stage with an estimated number of 700-1700 individual pits that collectively cover about 3 square kilometers. The artisanal mining is confined within the upper 80-150m of the tunnels.

In support of observation above, Bianchini (2010) and Priyadrshi (2012) argued that mining from time immemorial has remained a major environmental concern. The mining of mineral resources, whether by opencast or underground methods, has adverse environmental impacts. The magnitude and significance of these impacts, however, vary in case of different minerals depending upon the method of mining, scale and concentration of mining activity in conjunction with the geological and geomorphological setting of the area. The general environmental problems associated with most mining projects is depletion and degradation of existing surface water and aquifers, tailing leakage, leaching from dumps, land degradation, large scale deforestation, and hundreds of mine pits that are inactive and not refilled.

**Plate 1: Photo on one of the operating pits in block D in Mirerani Tanzanite mines**
***Source:*** Clashon (2011)

Production of wastes is another problem in the mining area causing land degradation. Huge heaps of mined out rock surround the mining pits without any protection around which means the mine pits are not protected from rock falling back into the pits. Through participant's observation, it was observed that there are lots of mounds of sand and rocks in the area which affect the vegetation. As indicated in plate 2, Tanzanite mining produces huge amount of rock wastes most of which are graphite and these wastes are dumped almost everywhere in the mining area without proper management, thus degrading the surrounding environment. In Mirerani, there is also the use of chemicals in separating gemstone from the soil and the liquid wastes that flows towards the residential settlement without proper channels and destination. This was observed in Naisinyai village where TanzaniteOne Mining Limited plant is established.

**Plate 2: Photo showing improper dumped rocks wastes from the mines in Mirerani**
***Source:*** Clashon (2011)

The production of wastes is also mentioned by Tesha (2010) who asserted that there is underground mining like Tanzanite which produces huge amount of wastes and also big number of pits which are uncovered even after they have been abandoned. Biachini (2010), Priyadrshi (2012), Kitula (2006), Mkpuma *et al.,* (2015), Betournay (2011), and Mwihava *et al.,* (2015) have also reported on the similar observations while URT (2014) argued that environmental impacts are one of the challenges facing Tanzanian mining industry.

**Deforestation, erosion, littering and illegal hunting**

The findings of the study showed that, mining

activities are the main sources of deforestation in the area Deforestation and piling of rock wastes causes gully erosion during the rainy season (plate 3). This finding is supported by International Council for Mining and Metals (ICMM) report of 2011. ICMM report showed that, the establishment of mining site and allied activities involves cutting trees or clearing of vegetation and in most cases without replacing them even when the minerals are exhausted thus leading to deforestation.

**Plate 3: Photo showing gully erosion as a result of small scale mining in Mirerani**

***Source:*** Clashon (2011)

Kumar (2015) and Orguela (2012) reported that, the mining area used to be a home for wild animals in the past, but some had shifted and others were killed by people when mining activities started. Mining is one of the major sources of deforestation in various parts of the world since the establishment of mines involves cutting of trees and other types of vegetation to enable mining to take place, and for the settlement of mine workers. Furthermore, clearance of ground cover and cutting of trees do accelerate soil erosion during rainy season and hence floods in lowland area like in Mirerani sub-town. Sinkala (2009), Opoku-Ware (2010), Belem (2011), and Mensah *et al.,* (2015) also argued that a greater proportion of the land areas which have been rendered bare due to mining activities result into massive gullies, excessive runoff, heavy erosion, reduced soil infiltration and consequent loss of land productivity.

## Conclusion and Recommendations

### Conclusion

The contribution of Tanzanite mining to the community's social development is very minimal and it is discriminative since Naisinyai village (Maasai village) is the only village which receives support from TanzaniteOne Company Tanzanite mining is the main stay of Mirerani people as everything including small business depend on mining. On the other hand, there are poor social services in the area since there is no tarmac road, no clean water and there is only one health care facility to serve the huge population of Mirerani. Tanzanite mining is causing environmental problems like wastes, land degradation, gully erosion, noise from explosive materials and littering. There is also use of chemical by the TanzaniteOne Company and the water from the plant is flowing to the environment without proper sewage or dam.

### Recommendations

The government of Tanzania is advised to make sure that villagers are involved in the whole process of mining from exploration to the exploitation stage to avoid any inconveniences with the local people. Additionally, the government of Tanzania is advised to formulate sound laws to make sure Tanzanite is mined and processed in the country before being sold in the international market to make sure that the country benefits as the sole producer of the gemstone. Likewise, there is a need to develop a plan to support ASM in terms of science and technology to enable them to compete in the industry and also increase production which will ultimately improve their livelihood and also reduce environmental impacts.

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**Abbreviations**

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|---|---|
| AfDB | Africa development bank |
| ASM | Artisanal small miner |
| ICMM | International council for mining and metal |
| IFIs | International financial institutions |
| GML | Gemstone mining licenses |
| KIA | Kilimanjaro international airport |
| MA | Mining activities |
| MEM | Ministry of energy and mineral |
| NMA | Non-mining activities |
| SML | Special mining licenses |
| SPSS | Statistical package for social sciences |
| UNECA | United nation's economic commission for Africa |
| UNEP | United nation's environmental programme |
| URT | United republic of Tanzania |